FLORA NOVO-GALICIANA

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ROGERS McVAUGH

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Editorial Committee: Howard Crum, Rogers McVaugh, Robert L. Shaffer

Volume 12, Part I, Number 3, pp. 1–93, 43 figures in text.

Price: $3.50

Volume 10 was published 18 September 1973 (erroneously reported as 19 September 1973 in Contr. Univ. Mich. Herb., volume 11, no. 1). Fewer than 100 copies were distributed. A second, corrected, printing of Volume 10 was published 10 January 1974. Volume 11, no. 1, was published 7 November 1973.

Early issues of the *Contributions* (Nos. 1–8) were published 1939–1942. The title-page and cumulative index for Nos. 1–8 were issued in 1966. For information about these or later issues of the Contributions, address the Director, Herbarium of the University of Michigan, Ann Arbor, Michigan 48104, U.S.A.

INTRODUCTION

The idea of a *Flora Novo-Galiciana,* of which this is the first part to be published, was conceived about 1950, soon after my first field-excursion to Jalisco. The project was nurtured at first by grants from the Horace H. Rackham School of Graduate Studies, University of Michigan, and has been supported generously since 1957 by the National Science Foundation, under grants G-3305, G-10665, GB-5218X, and GB-31133. The area covered by the Flora corresponds in a very general way to that of the old Spanish province of Nueva Galicia; what I am now calling Nueva Galicia includes the Mexican States of Aguascalientes, Jalisco, and Colima, and parts of Nayarit, Durango, Zacatecas, Guanajuato, and Michoacán. The boundaries of the area, the history of botanical exploration therein, and the principal vegetational features of Nueva Galicia in the modern sense, have been discussed in previous publications (Contr. Univ. Michigan Herb. 9: 1–123. 1966; ibid. 9: 205–357, map. 1972).

It is proposed to complete the Flora in 15 parts, of which 14 are to be devoted to flowering plants, and the last to the Pteridophyta. Arrangement by families is to be that of Cronquist, as set forth in 1968 (The Evolution and Classification of Flowering Plants, published by Houghton Mifflin Co., xi + 396 pp.)

Publication of this part was made possible by subventions from the National Science Foundation, and from the Rackham Endowment Fund, University of Michigan.

FAGACEAE. Beech Family

Monoecious trees or sometimes shrubs, the buds with imbricate scales; leaves alternate, usually petiolate, persistent or deciduous, penninerved, entire or dentate to deeply pinnatifid; stipules present, generally deciduous; flowers usually axillary on young branchlets, apetalous, the perianth 4–7-lobate; staminate spikes (aments) usually elongate, each bract inclosing a single flower; stamens as many or twice as many as the perianth lobes, rarely more numerous, the filaments usually slender; anthers 2-celled, the cells erect, parallel, sessile or short-stipitate at the apex of the filaments, dehiscent by a longitudinal slit; pistillate flowers solitary or in 3's, forming spikes or short clusters, sometimes borne at the base of the staminate spikes; ovary inferior, 3-locular or rarely 6-locular at base, with 3 styles, each locule 2-ovulate but all the ovules except one abortive; fruit a nut, solitary or 2–3 together, partly or wholly inclosed by an involucre or cupule; seed large, without endosperm, the cotyledons thick and fleshy.

Six to nine genera and 600 to 900 species depending upon taxonomic opinion, widely dispersed in both hemispheres, mostly in temperate and subtropical regions, rarely in truly tropical areas, in the tropics mostly confined to the mountains. In Mexico represented by indigenous species of *Fagus*, the beech (Sp. *haya*), and *Quercus*. The Old World chestnut (*castaño*, the tree, *castaña*, the nut), *Castanea sativa* Mill., may be cultivated occasionally.

QUERCUS L. Oak; *encino; roble*

References: Trelease, William. The American oaks. Mem. Nat. Acad. Sci. 20: 1–255. *pl. 1–420.* 1924. Muller, Cornelius H. The Central American species of *Quercus*. U.S. Dept. Agr. Misc. Publ. 477: 1–92. *pl. 1–124.* 1942. Muller, Cornelius H. The oaks of Texas. Contr. Texas Res. Found. 1, pt. 3: i–v, 21–311. 1951. Muller, Cornelius H., and Rogers McVaugh. The oaks (*Quercus*) described by Née (1801) and by Humboldt & Bonpland (1809), with comments on related species. Contr. Univ. Michigan Herb. 9: 507–522. 1972.

Shrubs to large trees with continuous star-shaped pith and usually hard wood; buds crowded toward the ends of the usually fluted twigs; stipules associated with the buds rather than the leaves, subulate to ligulate, promptly caducous or sometimes persistent; leaves usually distinctly petioled, never truly sessile; staminate flowers in elongate flaccid catkins, the calyx of 5 lobes fused into a more or less bowl-shaped perianth inclosing 5–10 free stamens with short anthers and slender filaments; pistillate flowers in a reduced catkin with a stiff woody rachis either short or long and 1- to several-flowered, the calyx of 6 lobes adhering to the bases of the styles and fused into a tube, the pistil of 3 carpels comprising a single 3-locular ovary (each locule

containing 2 ovules) and three free styles which are adaxially stigmatic toward the dilated apex; fruit unilocular, 1-seeded, the 5 remaining ovules aborting and adhering to the developed seed; seed inclosed in a shell (forming a nut or acorn) and seated in a cup or involucre formed (in our species) of scales (each with a more or less aborted vegetative bud in its axil), the cup enveloping the whole nut or covering it only at base.

A genus of perhaps 500 species in the Northern Hemisphere (absent from the Arctic); about 250 species occur in the New World, with by far the greatest concentration of species in Mexico. Many species of *Quercus* grow abundantly in various parts of Mexico, especially in the mountains and uplands, and several of them are so abundant as to form almost pure forest stands in some areas. Some species are important timber trees; others are much cut for the production of charcoal. No other genus except *Pinus* forms so large an element of the forest vegetation of upland Mexico. The oak forests of Nueva Galicia are described and characterized by Rzedowski & McVaugh (La vegetación de Nueva Galicia. Contr. Univ. Mich. Herb. 9: 55–68. 1966).

The Spanish names *roble* (originally applied to species of *Quercus* with deciduous leaves, e.g. *Quercus robur*), and *encino* or *encina* (originally a name for a plant with small evergreen leaves, *Quercus ilex*) are widely used for species of *Quercus* in Mexico. In Nueva Galicia the name *roble* is often applied to species having large, broad leaves, and that of *encino* to species with smaller leaves, but this practice is not consistently followed; sometimes the two names are confused, or combined in the form *encino roble*. Trelease reports several species that may be called either *encino* or *roble*, depending upon the locality and collector. Individual species may be known by vernacular names at the specific level, e.g. *encino colorado*, *encino chaparro*, *encino cucharilla*, etc., but like all vernacular names applied to species of large genera, the same one may be applied to different species in different localities. Trelease in his monograph (1924) consistently used the form *encino*, which is essentially the only one used by the country people in Mexico, but in the *Trees and Shrubs of Mexico* (1922) the form *encina* (the more usual Spanish spelling) was used.

The two eminent American students of *Quercus* in this century, Trelease and Muller, differed widely in their ideas of what constituted species. Trelease recognized 371 American species, in addition to numerous named varieties and forms, whereas according to statements in Muller's more recent publications, the actual number of species cannot be more than about 250, and may be even less than this. The tendency of systematists in recent years is to recognize the existence of considerable infraspecific variation, and to minimize the importance of individual variations when these can be better understood as parts of the variation within populations. Thus many of the varieties and forms, and even species, named by Trelease in 1924, are now readily accepted as integral parts of larger evolutionary units.

The following treatment of the oaks of Nueva Galicia could not have been written without the sympathetic assistance and counsel of Dr. C. H. Muller, who made all his notes on *Quercus*, and his extensive herbarium of the Mexican species, freely available to me. He read and criticized the key

and most of the rest of the manuscript before it was printed, and I am most grateful for his support and suggestions. Laboratory space at the Santa Barbara Botanic Garden, Santa Barbara, California, was put at my disposal while the manuscript was in preparation, through the kindness of the Director, Dr. Katherine K. Muller.

The types of all names, both those accepted and those included in synonymy, are mentioned below as far as possible. Types of the names proposed by Née, and by Humboldt & Bonpland, were reported upon by Muller & McVaugh (1972; see above), and are not specially designated in this Flora. Types of names proposed by other European authors (viz. Bentham, A. DeCandolle, Hooker & Arnott, Liebmann, Martens & Galeotti, Schlechtendal & Chamisso, and Warburg) have been identified during the preparation of the Flora from Professor Muller's extensive notes made in European herbaria in 1950 and 1958, and in some instances through study of isotypes in Muller's private herbarium. Types of names proposed by Trelease and Muller, if actually seen and studied, are designated by the usual sign [!]. Certain specimens cited by Trelease and others, but which I have not seen, are indicated thus: "?*Lamb 577.*"

In citing the names of species proposed by Humboldt & Bonpland in *Plantae Aequinoctiales*, the page-numbers of the rare issue (see Contr. Univ. Michigan Herb. 9: 511. 1972) are inserted between square brackets preceding the page-numbers of the more common issue, thus: **Quercus crassifolia** Humb. & Bonpl. Pl. Aequinoct. 2: [43] 49. *pl. 91*. 1809.

The illustrations in this part of the *Flora Novo-Galiciana* are all from drawings by Karin W. Douthit, whose talent speaks for itself, and whose patience and faithful attention to detail are here gratefully acknowledged.

1. All the leaves entire, sometimes mucronate or aristate at tip but without lateral teeth.
   2. Lower leaf-surface glabrous or practically so at maturity, often conspicuously glandular, sometimes with tufts of hairs in the axils of the large veins, or with some persistent pubescence along the large veins.
      3. Leaves commonly bluish-green, more or less waxy-glaucous and whitish-papillose beneath (this difficult to observe in young leaves or those dried with an excess of heat); blades obtuse at tips or, if subacute, never aristate; cup-scales thickened and canescent at base; acorn-shell glabrous on the inner surface (White Oaks).
         4. Leaves 3.5 cm long or less, relatively broad, oblong to elliptic or obovate; papillae of the lower leaf-surface obscure, often not discernible; whole plant glabrous or nearly so; edge of the Central Plateau. *Q. depressipes.*
         4. Leaves mostly more than 5 cm long, often long and narrow; plants often somewhat pubescent; papillae usually evident at magnifications of 15×–25×.
            5. Midvein convex or half-round on the lower surface; leaves flat (not rugose above), quite glabrous beneath at maturity, commonly about twice as long as wide. *Q. glaucoides.*
            5. Midvein elevated more than half its diameter from the lower leaf-surface (this evident at least toward the base of the blade); primary or secondary veins, or both, often impressed above; leaves even at maturity usually bearing some pubescence at least

along the midvein; blades often 2.5–3 times as long as wide, or longer.

6. Hairs of the lower leaf-surface pale brown, tending to be concentrated beside the midvein, with rather stiff arching branches; secondary veins, or many of them, nearly straight and connecting the primaries at right angles; inner cup-scales with coarse, loosely erect, narrowly triangular tips 2–3 mm long; young foliage not glandular. *Q. splendens.*

6. Hairs of the lower leaf-surface white or colorless, tending to be scattered on the veins, with contorted or crumpled branches; secondary veins often very irregularly branched; inner cup-scales with appressed tips; young leaves with stout simple reddish glandular hairs along the larger veins. *Q. laeta.*

3. Leaves commonly yellowish green or brownish beneath, neither waxy nor glaucous, the papillae if apparent lustrous or glassy, not white; blades obtuse to acute, often aristate at tips; cup-scales moderately or scarcely thickened at base; acorn-shell tomentose on the inner surface (Black Oaks).

7. Leaves bullate (pebbled) beneath, the smallest veinlets depressed between the convex bullae; blades narrow, 3–7 times as long as wide, acute to attenuate. *Q. gentryi.*

7. Leaves not bullate, the lower epidermis flat and smooth, often papillose, the areoles sometimes a little depressed, or the smallest veinlets convex.

8. Leaves very long and narrow, (4–) 5–11 times as long as wide, 1–4 (–6) cm wide, narrowly acute or attenuate at apex.

9. Leaves tapering from the broad rounded base to the narrow tips; primary lateral veins 6–9 on each side, evidently stronger than the intermediates if any, strongly arcuate-ascending, with slender straightish tips often extending to the middle of the next vein or beyond; young branchlets soon glabrous but persistently granular-glandular; leaves persistently glandular at least in sheltered places beneath. *Q. viminea.*

9. Leaves widest about the middle or if below the middle tapering both to the long tip and the somewhat narrowed base; veins 15–25 on each side, the larger ones not well differentiated from the smaller intermediate ones, most of them leaving the midvein at an angle of 45° or more, usually soon branching and anastomosing and with no prolonged tips. *Q. salicifolia.*

8. Leaves elliptic, ovate, or broader, mostly 2–3 (–4) times as long as wide, often 2–8 cm wide, acute or obtuse at apex.

10. Petioles glabrous, 8–15 (–22) mm long; branchlets glabrous; leaves drying brown beneath, glabrous except for tufts of hairs in the vein-axils, eglandular at maturity (young leaves unknown); epidermal papillae appearing to be concentrated in groups between the veinlets. *Q. praineana.*

10. Petioles and branchlets pubescent; petioles sometimes glabrescent, seldom if ever becoming wholly glabrous; leaves green beneath, often colored at least when young by the covering of reddish or yellow glandular hairs.

11. Leaves broadly obovate, usually broadly rounded at apex, stiff and thick, (3–) 7–14 cm wide, copiously waxy-glandular beneath; petioles stout, (5–) 8–13 mm long but

appearing shorter, usually much depressed between the projecting lobes of the leaf-base. *Q. coccolobifolia.*

11. Leaves elliptic, lanceolate, or ovate to obovate, if obovate and obtuse not glandular beneath, and seldom more than 5 cm wide.

12. Branchlets and petioles densely tomentose, the tomentum persisting 1–2 years; primary and often some of the secondary veins impressed above; lateral veins (10–) 15–20 on each side, including rather numerous large intermediate ones; leaves eglandular from the first, usually persistently pilose beside the midvein on the lower surface, usually elliptic and obtuse; acorn-cup saucer-shaped or flat, 12–17 mm wide. *Q. elliptica.*

12. Branchlets and petioles pubescent to nearly glabrous, usually glabrescent; veins not impressed above; lateral veins 5–12 on each side, the intermediate ones few and inconspicuous; leaves mostly acute or subacute and aristate, if obtuse mostly narrowly obovate; acorn-cup hemispheric or a little shallower.

13. Leaves commonly elliptic-ovate, attenuate or acuminate, persistently glandular beneath, 8–15 (–21) cm long; large veins from base to middle of leaf tending to be straight and nearly parallel and connected by ladder-like series of readily visible secondary veins; margins of the acorn-cup thick, strongly infolded. *Q. conspersa.*

13. Leaves commonly elliptic-lanceolate to oblanceolate or obovate, 4–10 (–13) cm long; large veins usually arcuate, not parallel, one or two of the lowermost on each side reduced and soon anastomosing, the connecting secondaries, or most of them, irregular or scarcely discernible; margins of the acorn-cup erect.

14. Leaves elliptic-lanceolate, acute or attenuate at tip; very young leaves and branchlets densely glandular, the glands sparingly persistent along the midvein on the lower surface; cool, humid, pine and fir forests, 2000–3000 m. *Q. laurina.*

14. Leaves elliptic-lanceolate to oblanceolate or obovate, broadly rounded or obtuse, or less often abruptly acute or subacute; leaves eglandular from the first; savannas, open wooded hills, on the Pacific slope, 250–1200 m. *Q. aristata.*

2. Lower leaf-surface uniformly and persistently but sometimes sparingly pubescent or tomentose, the hairs not especially concentrated near the midvein nor in the vein axils.

15. Leaves large (4–12 cm wide), long-petioled (petioles often 10–20 mm long), rugose, revolute, closely and densely brownish-yellow-tomentose beneath with sessile overlapping hairs; margins of acorn-cup inrolled almost to the bottom. *Q. fulva.*

15. Leaves smaller, seldom more than 5 cm wide and if so loosely pale-tomentose or -pubescent beneath; petioles mostly 2–6 (seldom 10–12) mm long.

16. Leaves markedly bullate beneath (the bullae sometimes obscured by the pubescence), the surface yellowish green (not glaucous), and bearing reddish or yellow glandular hairs; blades elliptic or lanceolate, 1–2.5 (–4) cm wide; margins of the cup usually much inrolled; fruiting peduncles much enlarged, 2–5 mm thick, with prominent lenticels.

17. Leaves densely tomentose beneath from the first (also bearing glandular hairs but these mostly concealed by the tomentum), rather abruptly rounded to an obtuse or subacute tip; margins revolute; upper surface gray-green, rugulose; smallest veinlets coarse and prominent, obtusely convex. *Q. crassipes.*

17. Leaves pubescent and strongly glandular beneath, at maturity nearly glabrous except for lines of hairs along the midvein and the bases of the large veins; blades mostly tapering to an acute tip; margins flat or essentially so; upper surface yellow-green, flat or the large veins impressed; smallest veinlets elevated in fine acute lines. *Q. gentryi.*

16. Leaves not bullate beneath, the surface flat between the veins or, if a little wrinkled, then glaucous and without glandular hairs.

18. Lower leaf-surface green, very smooth and somewhat polished, exposed between the numerous, whitish, many-branched and greatly contorted and tangled hairs; upper leaf-surface glabrous or nearly so, green and very glossy; blades 2–4.5 (–6.5) cm long, mostly 1–2 cm wide. *Q. eduardii.*

18. Lower leaf-surface completely obscured by the pubescence or, if visible through the hairs, glaucous and whitish-papillose.

19. Lower leaf-surface scantily pubescent, bearing scattered tangled many-branched sessile hairs on the veins and veinlets, the epidermis glaucous and whitish-papillose; plant as a whole sparingly pubescent. *Q. laeta.*

19. Lower leaf-surface densely and softly tomentulose, covered by the hairs but the epidermis sometimes barely visible through them, as seen under a lens; plants with gray- or yellowish-tomentose leaves and branchlets.

20. Hairs of the lower leaf-surface matted, including closely overlapping sessile hairs of several sizes, these quite obscuring the epidermis.

21. Leaves mostly 1–2 cm long; large veins impressed above; margins somewhat revolute; a rhizomatous shrub usually 1 m high or less; hairs of the upper leaf-surface crumpled, often barely or not at all overlapping; Guanajuato to western Durango. *Q. microphylla.*

21. Leaves 2–6 cm long or more; usually trees, 4–7 m high; hairs of the upper leaf-surface with straight spreading branches, usually much overlapping.

22. Leaves flat, the veins not impressed above, the margins flat or nearly so; blades mostly 2–4 cm long, and entire; cup 8–15 mm wide, with thin erect edges; northern Jalisco and southern Zacatecas northward. *Q. grisea.*

22. Leaves rugose, with impressed veins and veinlets, and markedly revolute margins; blades 4–8 (–14) cm long, coarsely sinuate-dentate to almost lobulate; cup 15–22 mm wide, with very thick incurved margins; northern Jalisco, southern Zacatecas, northern Nayarit. *Q. praeco.*

20. Hairs of the lower leaf-surface erect or nearly so, not matted, consisting of several branches united into a short but definite trunk, the epidermis readily observed between the bases of the hairs.
    23. Leaves evidently rugulose, the primary and secondary veins impressed above; margins strongly revolute.
        24. Leaves mostly less than 5 cm long and 2 cm wide; branchlets 1–2 mm thick; usually a rhizomatous shrub; anthers glabrous. *Q. frutex.*
        24. Leaves mostly more than 5 cm long, 1.5–3 (–5.5) cm wide; branchlets 1.5–4 mm thick; a tree up to 8–10 m high; anthers pilose? *Q. deserticola.*
    23. Leaves not rugulose, flat, the margins not or but slightly revolute; branchlets 2–4 mm thick. *Q. chihuahuensis.*

1. Leaves, or some of them, toothed or lobed or with mucronate or aristate margins.
    25. Teeth of the leaves rounded, blunt, or mucronate-tipped, if acute never spinose or aristate; stigmas abruptly dilated on short styles; fruit annual; cup-scales usually much thickened basally; acorn-shell glabrous on the inner surface; abortive ovules basal (White Oaks; subgenus *Quercus*).
        26. Branchlets of the current season densely and persistently tomentose, the hairs mostly persistent well into a second season or even longer.
            27. Leaves large, seldom less than 10 cm and often 15–30 (–50) cm long, mostly obovate or oblanceolate; branchlets 2–5 (–10) mm thick.
                28. Leaves green and nearly glabrous beneath, with scattered, erect, 2–7-branched hairs on the veins; blades mostly 8–12 cm wide, with 7–20 coarse teeth on each side; acorns very large, the cups (3–) 4–5.7 cm wide. *Q. oocarpa.*
                28. Leaves densely tomentose to thinly pubescent, the hairs overlapping, covering all or most of the surface; acorns smaller, the cups 1.2–2.5 cm wide.
                    29. Leaves mostly 8–20 cm wide, obovate, with 8–18 coarse teeth on each side, on very stout short petioles 4–6 mm long and often almost as thick, the old leaf-scars 5–8 mm wide; hairs of the lower leaf-surface sessile, with soft spreading branches. *Q. resinosa.*
                    29. Leaves mostly 2–7 (–13) cm wide, with 2–8 teeth on each side; old leaf-scars 1.5–4 mm wide.
                        30. Leaves acuminate, strongly whitened and waxy-glaucous beneath, and the surface wholly or partly covered with rather flat sessile hairs; petioles mostly 10–15 mm long. *Q. martinezii.*
                        30. Leaves obtuse or rounded, seldom subacute, pale beneath, the epidermis glaucous but mostly covered by yellowish-white erect stalked hairs; petioles mostly 2–5 mm long. *Q. chihuahuensis.*
            27. Leaves small, seldom more than 12 cm long, usually less, often narrow, sometimes obovate; branchlets 1.5–4 mm thick.
                31. Lower leaf-surface with many small yellow or reddish simple glandular hairs, and pale, sessile, contorted or collapsed, several-branched hairs more or less covering but not hiding the glaucous epidermis; leaves mostly obovate to suborbicular, and rounded to obtuse at apex, with 7–8 distinct teeth or mucros on each side; veins and branchlets often reddish. *Q. potosina.*

31. Lower leaf-surface not obviously glandular-puberulent, but densely and softly tomentulose, covered by the hairs, the epidermis sometimes (under a lens) barely visible through them; leaves various, the teeth (if any) mostly coarse and blunt, seldom more than 3–5 on each side; plants with gray or yellowish leaves and branchlets. [See second "19" in key above.]

26. Branchlets of the current season glabrous or glabrescent, if at first tomentose the hairs easily detached and often all or mostly deciduous before the end of the season.

32. Lower leaf-surface glabrous or practically so at maturity, sometimes with tufts of hairs in the axils of the large veins, or with some persistent pubescence along these veins.

33. Leaves 3.5 cm long or less, relatively broad, oblong to elliptic or obovate; papillae of the lower leaf-surface obscure, often not discernible; whole plant glabrous or nearly so; edge of the Central Plateau. *Q. depressipes.*

33. Leaves mostly more than 5 cm long; plants often somewhat pubescent; papillae usually evident at magnifications of 15× –25× .

34. Leaves bearing tufts of coarse hairs in the vein-axils beneath, otherwise glabrous or with minute flat sessile stellate hairs on the lower surface; lower surface pale green, not glaucous; blades mostly oblanceolate or obovate, tapering to a narrow acute or abruptly rounded base. *Q. glaucescens.*

34. Pubescence of lower leaf-surface not concentrated as tufts in the vein-axils, if present usually as scattered hairs along the veins or beneath them; lower surface often waxy-glaucous; blades variously shaped.

35. Leaves bronzy-green with reddish veins, lustrous on both sides, not glaucous beneath, at least a few soft tangled stellate hairs and traces of reddish glandular puberulence persisting along the elevated and usually nearly terete midvein; blades mostly 5–9 cm wide, elliptic to obovate, 1.5–2.5 times as long as wide, with petioles 5–10 mm long; mostly from Sinaloa northward. *Q. tuberculata.*

35. Leaves dull and glaucous beneath (this often difficult to observe in young dried leaves or those dried with an excess of heat); veins pale, seldom pinkish; lower surface quite glabrous or stellate-pubescent especially along the midvein, if glandular rather generally so; leaves and petioles various.

36. Leaves acute at tip, oblanceolate to lanceolate, mostly 10–20 cm long, 2.5–3.5 times as long as wide, usually serrate with 5–10 teeth on each side, glabrous beneath (or with a few minute flat stellate hairs), but usually with some stiff, simple hairs persisting on the midvein; veins 10–15 or more on each side, not impressed above. *Q. excelsa.*

36. Leaves obtuse to broadly rounded at apex, elliptic to obovate or oblanceolate (if subacute and more than 2.5 times as long as wide then commonly entire and with impressed veins).

37. Leaves glabrous and eglandular beneath, commonly blunt-tipped, oblong to obovate, 2–2.5 times as long as wide, the margins puckered and sinuate-

dentate; midvein convex or half-round on the lower surface, tapering off on the sides; veins not impressed above. *Q. glaucoides.*

37. Leaves either with coarse branched hairs along the midvein beneath, or minutely pale-puberulent or glandular; primary or secondary veins, or both, often impressed above; midvein often much elevated above the lower surface, terete or nearly so in cross-section.

38. Leaves mostly obovate, (3–) 6–12 cm wide, about twice as long as wide, shallowly sinuate-dentate with 5–10 undulations on each side, more or less glandular-puberulent (sometimes obscurely so) on the surface beneath. *Q. subspathulata.*

38. Leaves mostly elliptic, oblong, lanceolate or oblanceolate, 2–6 cm wide, 2.5–3.5 times as long as wide, often entire, sometimes coarsely toothed above the middle, eglandular or with reddish glands along the larger veins. [See second "5" in key above.] *Q. laeta, Q. splendens.*

32. Mature leaves uniformly, and usually copiously, pubescent to tomentose beneath at maturity, the hairs sometimes scattered on the veinlets but not confined to the vicinity of the midvein.

39. Leaves bearing tufts of coarse hairs in the vein-axils beneath, pale green but not glaucous, usually appearing glabrous to the unaided eye but often having few or many minute flat sessile hairs on the surface; veins not impressed; lower surface not bullate. *Q. glaucescens.*

39. Pubescence of lower leaf-surface not concentrated as tufts in the vein axils, usually abundant, the hairs evident, usually overlapping, many-branched and tangled; veins usually impressed above; lower surface usually waxy-glaucous.

40. Hairs of the lower leaf-surface erect, stipitate, their branches seemingly united into a short linear trunk; surface discernible through the hairs, eglandular, glaucous and white-papillose; fruiting peduncles often 5–7 cm long. *Q. peduncularis.*

40. Hairs of the lower leaf-surface sessile or essentially so, the branches evidently spreading from a common base, suggesting the branches of a clump-forming shrub; surface usually glandular, the vermiform reddish or yellowish simple glandular hairs sometimes concealed by the close tomentum.

41. Lower leaf-surface eglandular, the larger veins bearing some glandular hairs at least when young; pubescence sparse, the soft tangled hairs scattered on the veins, exposing the pale smooth epidermis; leaves commonly narrowly elliptic to oblong or oblanceolate, 2–3 (–6.5) cm wide, 2–4 times as long as wide; peduncles mostly 1–2 cm long. *Q. laeta.*

41. Lower leaf-surface glandular, the glandular hairs usually very numerous and conspicuous or, in 2 species, concealed by the close tomentum; leaves commonly broadly or narrowly obovate; peduncle commonly 2–5 (–10) cm long.

42. Lower leaf-surface green, not glaucous, more or less bullate and finely glandular-puberulent but the bullae and glands usually concealed by the closely tangled hairs; leaves commonly large, thick and obovate, 15–30 cm long, 7–20 cm wide, with 8–18 coarse

teeth on each side; anthers pilose; leaf-scars 3–8 mm wide.

43. Branchlets 4–10 mm thick, heavily and densely tomentose, the tomentum usually persistent several years; large leaf-scars often 5–8 mm wide; petioles 4–6 (–10) mm long, tomentose, somewhat hidden in the leaf-bases and the leaves appearing subsessile; lower epidermis smooth or wrinkled. *Q. resinosa.*

43. Branchlets 2–4 mm thick, at first thinly stellate-pubescent, glabrescent and often essentially glabrous before the end of the first season; large leaf-scars 3–5 mm wide, seldom wider; petioles, at least the larger ones, 5–12 mm long, soon glabrous or nearly so, the leaves evidently petiolate; lower epidermis strongly bullate. *Q. magnoliifolia.*

42. Lower leaf-surface whitened, glaucous, copiously glandular, bearing many soft, branched hairs, these usually tangled and overlapping but not hiding the surface or the glandular hairs; leaves (on the average) smaller, obovate to suborbicular, 7–15 cm long or less, 3–8 cm wide, with 5–8 (–15) teeth on each side, the teeth often low or irregular or reduced to marginal mucros; anthers often glabrous; leaf-scars 1.5–4 mm wide, or wider on vigorous shoots.

44. Leaves 2–6 (–9) cm long, nearly flat, usually not markedly rugulose above, the pale, glaucous epidermis not bullate beneath; margins usually sharply serrate or denticulate with 7–8 teeth on each side; veins and petioles usually reddish; upper leaf-surface abundantly and persistently stellate-pubescent; peduncles 1–3 cm long; dry woodlands of the Central Plateau. *Q. potosina.*

44. Leaves mostly 7–15 cm long or more, evidently rugulose above and more or less bullate beneath; margins rather irregularly sinuate-dentate to subentire or serrate; veins pale, or reddish especially when young; upper leaf-surface often practically glabrous at maturity, the hairs sometimes persisting in sheltered places; peduncles 2–10 cm long; mountain forests, often with pine or fir.

45. Primary and secondary veins all impressed; leaves very thick and rigid, usually cupped (concave beneath), commonly broadly obovate (1.3–2 times as long as wide); margins not strongly revolute, with definite straight mucros up to 1 mm long in the plane of the leaf; lower leaf-surface usually copiously pilose, the crumpled hairs with branches up to 1 mm long; petioles 2–4 mm thick at base, usually strongly depressed between the infolded sides of the leaf-base; peduncles often 6–10 cm long; cup 10–15 mm wide; acorns narrowly ovoid, (10–) 15–25 mm long, 8–12 (–15) mm thick. *Q. rugosa.*

45. Primary veins little or not at all, the secondaries evidently impressed; leaves coriaceous, not rigid, usually flat (not cupped), commonly long-obovate (1.7–2.4 or up to 2.8 times as long as

wide); margins commonly revolute, with mucros broader than high, and mostly thickened on the lower leaf-surface or curved down as if with the revolute margin; lower leaf-surface glandular, but sparingly pilose, the crumpled hairs with branches hardly 0.5 mm long; petioles 1–2 mm thick at base, commonly in the plane of the leaf, the leaf-bases often flat; peduncles 2–6 cm long; cup 15–25 mm wide; acorns broadly ovoid, (12–) 17–20 mm long, (10–) 15–18 mm thick. *Q. obtusata.*

25. Teeth of the leaves aristate, never rounded; stigmas gradually (rarely abruptly) dilated, on long styles; fruit annual or biennial; cup-scales scarcely thickened basally (or if so the leaves definitely as above); acorn-shell tomentose on the inner surface; abortive ovules usually apical (Black or Red Oaks; subgenus *Erythrobalanus*).

46. Lower leaf-surface glabrous or practically so at maturity, sometimes with tufts of hairs in the axils of the large veins, or with some persistent hairs along the midvein and the bases of the primary lateral veins.

47. Leaves very long and narrow, mostly 1.5–2.5 cm wide and 5–6 times as long as wide, tapering from the broad rounded base to the prolonged aristate tip, persistently glandular at least in sheltered places beneath. *Q. viminea.*

47. Leaves relatively broader and shorter, mostly 2–6 cm wide or wider, if narrower then seldom more than 3–4 times as long as wide, usually noticeably narrowed to both base and apex, and often widest at or just below the middle.

48. Leaves broadly obovate, usually broadly rounded at apex, stiff and thick, (3–) 7–14 cm wide, copiously waxy-glandular beneath; petioles stout, (5–) 8–13 mm long but appearing shorter, usually much depressed between the projecting lobes of the leaf-base. *Q. coccolobifolia.*

48. Leaves elliptic, lanceolate, or ovate to obovate, if obovate and obtuse not glandular beneath, and seldom more than 5 cm wide; petioles mostly in the plane of the leaf.

49. Leaves commonly 4–10 (–13) cm long, often entire, sometimes with 1–5 teeth or aristae near the tip or above the middle; large veins usually arcuate, not parallel, one or two of the lowermost on each side reduced and soon anastomosing, the connecting secondaries, or most of them, irregular or scarcely discernible. [See second "13" in key above.] *Q. laurina, Q. aristata.*

49. Leaves commonly 8–15 (–25) cm long, with 5–15 ascending aristate teeth on each side, the teeth often extending from near base to apex of the blade; lateral veins commonly nearly straight and parallel, connected by readily discernible secondary veins.

50. Branchlets and petioles densely and persistently yellow-tomentose; leaves (3.5–) 6–10 cm wide, eglandular at maturity, acute or attenuate at the narrow aristate tip, with 10–14 teeth on each side; acorn cup 20–22 mm wide, with erect margins. *Q. uxoris.*

50. Branchlets and petioles at most thinly tomentose, usually soon glabrescent; leaves commonly 3–5 (–10) cm wide, with few or many teeth, often glandular beneath; cup various.

51. Teeth 6–10 (–15) on each side of the leaf; margins of the cup not inrolled. *Q. acutifolia.*

51. Teeth 1–6 on each side of the leaf; margins of the cup much inrolled. *Q. conspersa.*

46. Lower leaf-surface uniformly and persistently pubescent or tomentose.

52. Hairs of lower leaf-surface sessile, usually crowded, overlapping, and obscuring the surface, often soft, crisped or contorted and tangled.

53. Lower leaf-surface smooth and lustrous, not bullate, sparsely pubescent or at most thinly covered by the soft, tufted and contorted hairs; blades 2–4.5 (–6.5) cm long, markedly lustrous and flat above, the veins not impressed. *Q. eduardii.*

53. Lower leaf-surface bullate, usually completely covered and obscured by the crowded and overlapping hairs; blades often much larger, or with impressed veins.

54. Lower leaf-surface brown, densely tomentose with brownish hairs and conspicuously sprinkled with reddish-brown or yellowish glands among the other hairs; blades 4–8 (–12) cm wide, usually entire, broadly elliptic to obovate; margins of the cups inrolled almost to the bottom. *Q. fulva.*

54. Lower leaf-surface gray or white, obscurely if at all glandular; leaves usually prominently aristate-toothed; margins of the cups usually not inrolled.

55. Leaves dark or bright green above, the small pale veinlets and thick cartilaginous margins contrasting markedly with the green areas between them; blades mostly subcordate or truncate at base, the thickened margins easily discernible from above.

56. Petioles 10–20 (–40) mm long; leaves mostly 5–12 cm wide, obovate and sharply acuminate, flat or seldom a little rugulose; branchlets 2–5 mm thick, rather persistently yellow-tomentose; fruit biennial. *Q. candicans.*

56. Petioles (3–) 5–12 (–20) mm long; leaves mostly 2–3.5 (–7.5) cm wide, if obovate usually obtuse, evidently rugulose both fresh and dry; branchlets 1–2 mm thick, glabrous or nearly so by the end of the first season; fruit annual. *Q. castanea.*

55. Leaves gray-green above, the small veinlets (as seen under a lens) scarcely differentiated, not conspicuously paler than the areoles between them; margins revolute, the cartilaginous thickening scarcely discernible from above because of its position and the paleness of the adjacent surface; fruit annual.

57. Leaves cordate-auriculate at base, convallate (the basal part of the midvein lower than the sides of the blade), 3.5–7.5 cm long, the apex toothed and obtuse or the short terminal tooth deltoid; petioles 3–9 mm long; spine-like tips of the teeth 1–1.2 mm long or less. *Q. sideroxyla.*

57. Leaves acute or cuneate to gradually rounded at base, flat or nearly so, (5–) 8–12 (–17) cm long, narrowly acute or the large acute terminal tooth extending well beyond the lateral ones; petioles (5–) 8–20 (–28) mm long; spinelike tips of the teeth 1–3 mm long. *Q. scytophylla.*

52. Hairs of the lower leaf-surface shortly stipitate, erect, their bases not crowded, their ascending branches often overlapping and tangled but readily separated to reveal the epidermis.
    58. Hairs golden, not forming a dense tomentum in full-grown leaves; leaves thin, not rugulose, 2.5–3 times as long as wide, with narrow acute or attenuate aristate tip and 10–14 ascending long-aristate uniformly distributed teeth on each side. *Q. uxoris.*
    58. Hairs gray, grayish brown or brown, usually persistent and forming a loose tangled tomentum at least along the midvein; leaves 1.5–2.5 times as long as wide, with abruptly acute to obtuse or broadly rounded tip, and (1–) 3–6 (–10) aristate teeth on each side, chiefly above the middle.
        59. Leaves very thick and rugose, the veins and veinlets forming a strongly impressed network on the upper surface; lower surface persistently tomentose; acorn-cups hemispheric, 7–17 mm wide, the margins not inrolled; moderately dry interior oak-pine forests, 1800–2800 m.
            60. Leaves cupped (concave beneath), usually broadly obovate to suborbicular and broadly obtuse at apex, thinly gray-tomentose beneath; pistillate flowers and fruits several or many, clustered toward the tips of peduncles up to 5–8 cm long. *Q. urbanii.*
            60. Leaves flat (not cupped), usually obovate to elliptic and abruptly narrowed to an obtuse or acute, usually acuminate and aristate, tip, densely but rather loosely brown-tomentose beneath; pistillate flowers and fruits usually 1–2, nearly sessile, the peduncle up to 1 cm long. *Q. crassifolia.*
        59. Leaves thin, flat, neither cupped nor rugulose, the large veins sometimes a little impressed; lower leaf-surface tomentose and pale yellow-brown in young leaves, soon glabrescent except along the veins; blades elliptic to ovate or obovate, acute to obtuse; acorn-cups saucer-shaped or very flat, 20–30 mm wide, with thick and deeply inrolled margins; foothills of the Pacific slope, 750–1300 m. *Q. planipocula.*

Quercus acutifolia Née, An. Ci. Nat. 3: 267. 1801.

Ravines, open wooded slopes, mountainsides with other oaks, or oaks and pines, barranca-forest with *Carpinus, Tilia* and *Ternstroemia,* sometimes on limestone, 1500–2500 m. Talpa de Allende (above Los Sauces, on the headwaters of an east branch of Río de Talpa, *McVaugh 21446*); 20–25 km southeast of Autlán (Sierra de Manantlán, *McVaugh 10258, Rzedowski 14548*); Tecolotlán (Cerro La Coronilla, *Martínez's collector 2208*); Pihuamo (*M. Martínez 164a*); Tancítaro (Apo, *McVaugh 24886*). Jalisco, Michoacán (35 km west of Morelia, *Rzedowski 18366*), Edo. de México (Valle de Bravo, *Muller 9087, 9095*), Guerrero (beyond the Río Mezcala, on the road from Acapulco to Mexico, *Née,* the type), Oaxaca. Mountains of the Pacific slope of Mexico, seldom collected. The collections cited above are the only ones known from Nueva Galicia. "Encino saucillo" (Jalisco); "encino blanco" (Michoacán, Oaxaca); "encino laurelillo" (Michoacán); "encino tepozcohuite" (Guerrero).

A tall forest tree up to 20–30 m high and 1 m in diameter, with roughly furrowed hard black bark; branchlets 1–2 (–3) mm thick, at first thinly and loosely stellate-

Fig. 1. *Quercus acutifolia.* Leaves, × ½; left to right, *R. Hernández 26* (Guerrero), *Muller 9160* (Guerrero), *McVaugh 21446* (Jalisco), *Rzedowski 15916* (Guerrero); twig with cup, × 1, *R. Hernández 26.*

pubescent or -tomentulose, becoming nearly or quite glabrous before the end of the first season, reddish-brown and lustrous, the lenticels many but sometimes very inconspicuous; buds ovoid, acute, 3–6 mm long, the inner scales pilose; stipules 8–12 mm long, scarious, membranous, pilose, linear-oblanceolate, 1–2 mm wide, deciduous before the leaves are full grown; leaves deciduous, when very young green but thinly stellate-pubescent, sparingly glandular-puberulent at least along the midvein, and bearing some long straight simple hairs on the midvein; mature leaves essentially glabrous and eglandular, or often with tufts of coarse erect stellate hairs in the vein axils, seldom glandular; blades rather thin but stiff and coriaceous, green both sides (a little paler beneath), narrow with long-drawn out tips, narrowly elliptic to lanceolate, oblanceolate or (often in shade forms) ovate or obovate, (6–) 8–12 (–21) cm long, (1.5–) 2.5–5 (–8.5) cm wide including the teeth, (2.5–) 3–4 times as long as wide, attenuate, or acuminate to a narrowly acute aristate tip, usually narrowed and obtuse at base, but varying from narrowly or even broadly rounded to cuneate; margins thickened but only slightly revolute, conspicuously aristate-toothed from base to apex, or at least from the middle or below, the teeth 6–10 (–15) on each side, ascending or with salient tips, broad and low (the margin then subentire and the teeth marked chiefly by the spreading aristae), or acutely triangular and up to 5–8 mm long or more (the margin then coarsely serrate); aristae mostly 2–6 mm long; large primary veins

passing directly into the teeth, and equalling them in number; intermediate veins often alternating with the primary ones, branching and anastomosing before reaching the margin; upper leaf-surface hard, somewhat lustrous, flat, the veins and veinlets in dried leaves forming an elevated pale reticulum apparent to the unaided eye; lower surface scarcely paler, a little more yellowish, the large veins a little more elevated than on the upper surface, the small veinlets about equally conspicuous on the two wides; petioles usually long and slender, (5–) 10–20 (–45) mm long, 1–1.5 (–2.5) mm thick at base, glabrous or retaining a few hairs in the axil; staminate aments (according to Trelease) 5 cm long, at length rather loosely flowered, with glabrous, ellipsoid, mucronate anthers; pistillate flowers 1–4, scattered along the distal half of a glabrous peduncle 5–15 mm long; fruit biennial, solitary or paired, the peduncle becoming 2.5–4 mm thick, 7–15 mm long or less; cup hemispheric or often shallower, 13–18 mm wide, 6–8 mm high, the brown scales thinly pale-tomentose, somewhat hard and thickened at base, the triangular, very obtuse tips closely appressed, not incurved; acorn broadly ovoid, 14–16 mm long, 12–14 mm wide, pale brown, about one-third included.

It is very difficult to distinguish sterile specimens of *Quercus acutifolia* from forms of *Q. conspersa* having aristate-serrate teeth on the leaves. The problem is not usually a troublesome one in Nueva Galicia, where the prevailing form of *Q. conspersa* has all or most of the leaves entire, but from Guerrero to Central America the two species are easily confused. The character of the infolded cup-margin in *Q. conspersa* is a very distinctive one, but more field-studies are needed to show the extent of its occurrence. Very few fruiting specimens of *Q. acutifolia* are known, but in all these the cup-margins are erect rather than infolded.

In Nueva Galicia what has been called *Q. acutifolia* is a plant having leaves essentially glabrous and glandless at maturity, often narrowed to the base, with 6–10 teeth on each side. Née's original specimens, however, were from a plant or plants with ovate-lanceolate, long-attenuate and conspicuously glandular leaves, broadly rounded at base, with no more than 5–7 coarse lobe-like teeth on each side. This is a common leaf-form in Guerrero, the type-region, where both *Q. acutifolia* and *Q. conspersa* occur. It seems that plants having the cups of *Q. conspersa* tend to have leaves of an ovate type, rounded toward the acute or acuminate tip, and of noticeably firm texture, whereas the open cups of *Q. acutifolia* seem to be associated with triangular-lanceolate leaves with long-attenuate tips and somewhat thinner texture.

Alphonse DeCandolle (in DC. Prodr. 16, pt. 2: 66. 1864) treated *Q. conspersa* as a variety of *Q. acutifolia.* Warburg (Kew Bull. 1939: 93–94. 1939) noted the relationship between the two, saying "It is possible that *Q. conspersa* will ultimately be reduced to the little known *Q. acutifolia*."

Quercus acutifolia f. *abrupta* Trel. Mem. Nat. Acad. Sci. 20: 192. 1924, from the vicinity of the Nevado de Colima (*Ross 534,* the type) is, according to Muller's notes taken on the type in Munich, not *Q. acutifolia* but perhaps a hybrid with some other black oak, e.g. *Q. candicans.*

Quercus aristata Hook. & Arn. Bot. Beech. Voy. 444. 1841. *Quercus productipes* Trel. Mem. Nat. Acad. Sci. 20: 140. *pl. 264.* 1924.

Sparsely wooded hills, open oak and oak-pine woodlands, pastures and other disturbed habitats, savannas with *Curatella* and *Byrsonima,* 250–1200 m, fruiting September to November. Jesús María (*Feddema*

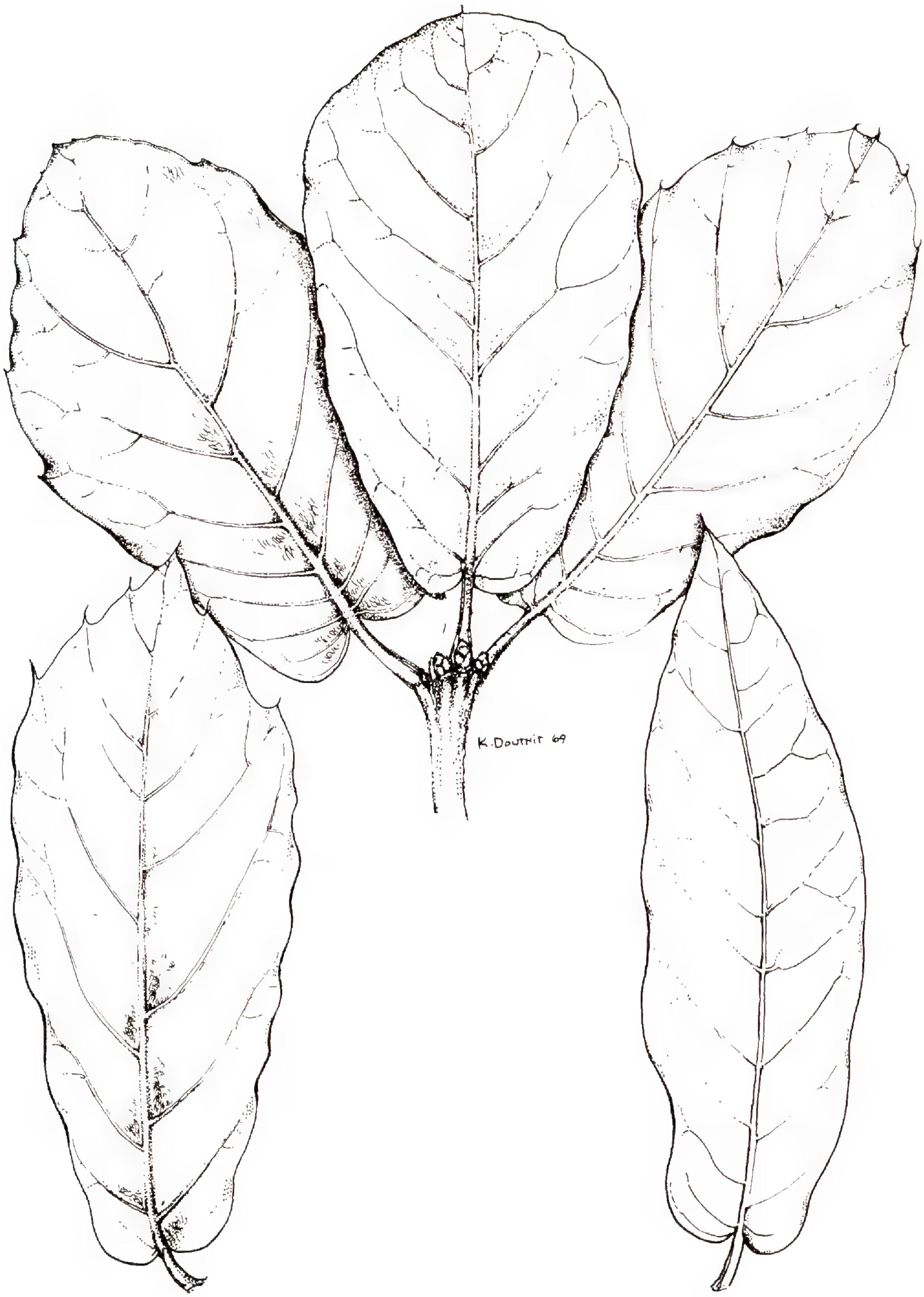

Fig. 2. *Quercus aristata*, × 1. Leafy twig, *Feddema 1386*; leaf, lower left, *Gentry & Gilly 10748*; lower right, *McVaugh 18769*. All from Nayarit.

1386); Zopilote (?*Lamb 577*); San Blas (*Rzedowski 14397*); between San Blas and Tepic (*Sinclair,* the type); savanna 12–15 km west of Jalcocotán (*McVaugh 18769*); 3 km west of Mazatán (*Rzedowski 17905*); near San Leonel (*Gregg 977*!, type of *Q. productipes*); between Ocotillo & Jazmines (*McVaugh 12060*); Ixtlán to Juanacata (*Mexia 905*); Compostela (*M. Martínez 31*); Llano Grande, between La Cuesta & Tomatlán (*Feddema*). Sinaloa (*Rose 1643*), Nayarit, western Jalisco.

A rather short tree 4–12 m high, with trunk up to 30–40 cm thick and dark or bright green very stiff leaves; branchlets 2–5 mm thick, at first densely but thinly pale-tomentose, the tomentum easily rubbed off but often persistent in sheltered spots, the bark reddish brown to black, the lenticels very inconspicuous; buds ovoid, obtuse, plump, 2.5–4.5 mm long, dark brown, the scales ciliate; stipules linear, scarious, membranous, pubescent, 5–10 mm long, deciduous before the leaves are full-grown; leaves when young closely and finely tomentulose beneath, green and minutely stellate-pubescent above; mature leaves rigidly coriaceous, nearly concolorous, a little paler and yellower beneath than above, evergreen, elliptic-lanceolate, elliptic-oblanceolate, or sometimes obovate or ovate, (4–) 7–12 cm long, 2–6 cm wide, 1.5–2.5 (–3) times as long as wide, broadly rounded or obtuse, or less often acute or subacute at the usually aristate tip, more gradually narrowed to the cordate or sometimes merely abruptly rounded base; at least a few of the leaves on any given plant usually entire; margins strongly cartilaginous-thickened, not or scarcely revolute, often undulate and bearing 1–5 aristae on each side near the tip of the blade or above the middle, the aristae terminating veins or veinlets and occasionally marking the tips of coarse marginal serrations; veins 5–12 on each side, with few or no small intermediates, arcuate-ascending, branched and anastomosing well within the margins, diminishing rapidly in thickness from base to apex, the small branches near the margin not or scarcely visible to the unaided eye; upper surface hard, dull or slightly lustrous, essentially glabrous except (usually) at the base of the midvein, flat, the veins and veinlets slightly convex, pale on a green background; lower surface somewhat yellow in drying, glabrescent, often with patches of pale short stellate hairs persisting especially near the larger veins, these pale and convex, conspicuous, the veinlets less conspicuous than on the upper surface, the epidermis flat, densely papillose on the veinlets and on the spaces between them; petioles 4–7 (–12) mm long, 1.5–2 mm thick, tomentose or finally glabrescent; staminate aments (according to Trelease) 5 cm long, loosely hairy, the anthers oblong, glabrous; pistillate flowers 1–6, scattered along a stout peduncle 1 (–3) cm long; fruit annual, solitary or paired, subsessile; cup hemispheric, 10–15 mm wide, with thin appressed, ovate, obtuse, canescent scales with brown glabrescent margins and erect or incurved tips; acorns round-ovoid, 12 (–16?) mm long, half-included.

Quercus candicans Née, An. Ci. Nat. 3: 277. 1801. *Quercus calophylla* Schlecht. & Cham. Linnaea 5: 79. 1830.

Mountain slopes, barrancas, usually a constituent of humid forests with pines, firs, and other oaks, 1600–2500 m, fruiting September to November. Often one of the dominant forest trees in mature pine-oak or pine-fir forests. Santa Teresa (*Rose 3446*); Sierra Madre west of Bolaños (*Rose 2999*); Cerro Sangangüey (*Breedlove 8057*); Cerro Tequila (*McVaugh 23889*); San Sebastián (*Mexia 1721*); 10–15 km southwest of Talpa de Allende (*McVaugh 14348*); Santa Mónica (*McVaugh 14112*); Autlán (*Wilbur 1974*); Nevado de Colima (many collections, including those cited by Trelease as from "near Colima" and from "Cerro Grande, Jalisco"; Tecalitlán (*M. Martínez 177*); Cerro Grande, La Piedad (*Rzedowski & McVaugh 501*); Coalcomán (Dos Aguas, *McVaugh 22850*); Tancítaro

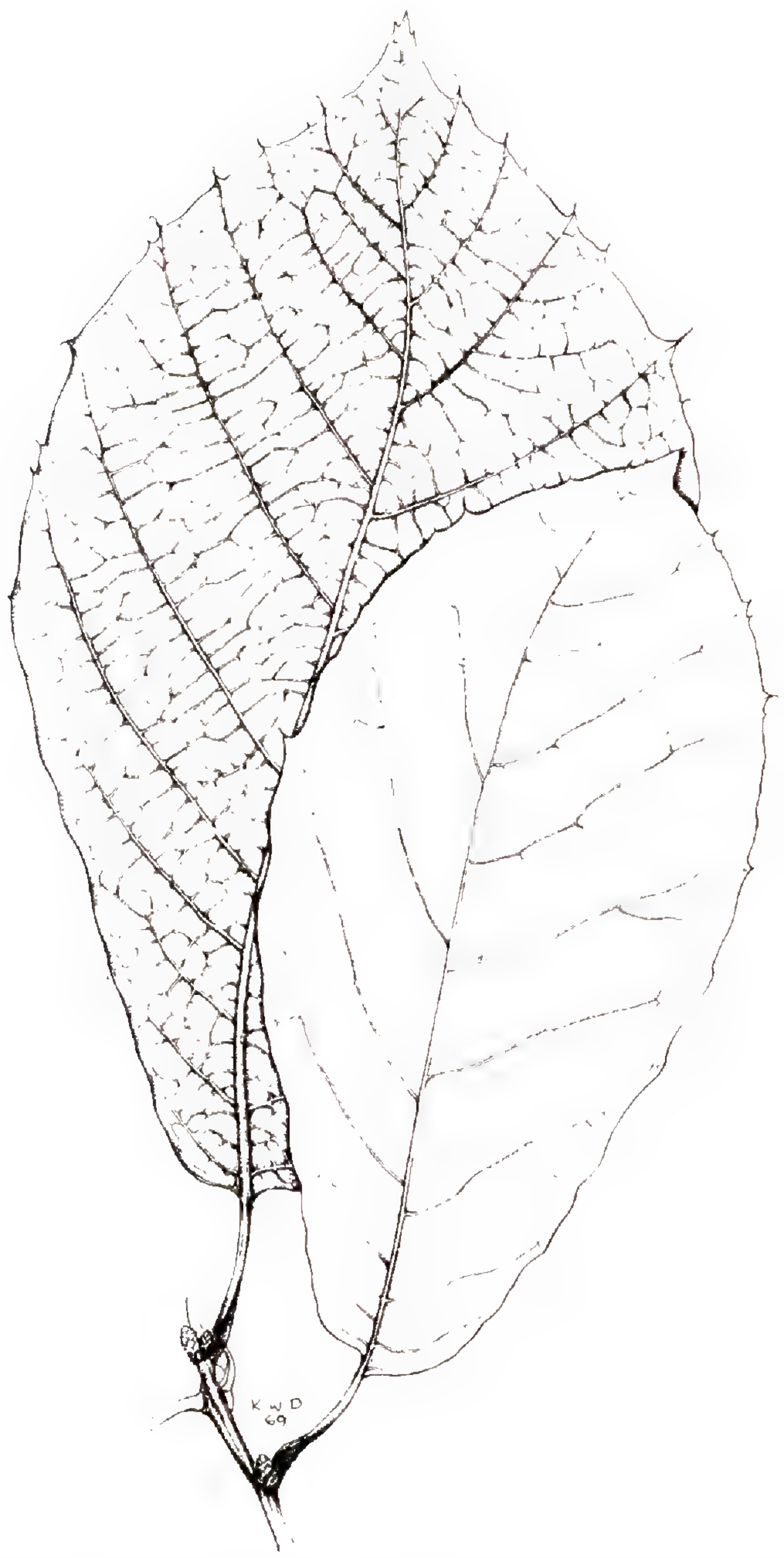

Fig. 3. *Quercus candicans,* × ½. *McVaugh 23889* (Jalisco).

(?*Nelson 6903*). Western Durango, northern Nayarit and adjacent Sinaloa, Jalisco, Guanajuato, Michoacán, Morelos, Edo. de México, Guerrero (near Tixtla, *Née,* the type), Oaxaca, Veracruz (*Schiede,* type of *Q. calophylla*), Hidalgo, Chiapas, Guatemala.

A large tree, up to 20–25 m high, with trunk up to 1 m or more in diameter; branchlets 2–5 mm thick, at first densely covered with a yellowish-brown or sordid tomentum extending to cover the petioles and the base of the midvein on the upper leaf-surface; hairs long-persistent, the branchlets ultimately glabrescent, dark reddish brown, with inconspicuous lenticels; buds (3–) 5–7.5 mm long, long-ovoid, pointed, reddish-brown, the inner scales appressed-pilose and long-ciliate; stipules linear or strap-shaped, 10–12 mm long, 1–1.5 mm wide, scarious, pilose, deciduous when the leaves are very small; leaves when young very densely tomentose beneath and loosely stellate-tomentose above; mature leaves thick and coriaceous, dark glossy green above, strongly whitened beneath, deciduous, often turning red before falling, mostly obovate, sometimes narrowly so, (8–) 12–20 (–25) cm long, (3–) 5–12 (–15) cm wide, 1.5–2.5 times as long as wide, rounded to a sharply acuminate and aristate tip, more gradually rounded from the middle or above to a subcordate or truncate base, or

abruptly narrowed to the petiole; margins cartilaginous-thickened, scarcely revolute, coarsely aristate-toothed at least above the middle and often nearly to the base of the blade, sometimes nearly entire except for the projecting aristae 1–6 mm long, but usually with coarse low serrations or even lobe-like teeth up to 1 cm high; veins 8–12 on each side, the upper ones straight and strongly ascending, passing directly into the teeth, the lower ones arching and anastomosing; upper surface hard, lustrous, essentially glabrous except at the base of the midvein, the veins and veinlets pale, sometimes slightly impressed but convex, forming a contrasting network on a green background; lower surface densely white-tomentose (the hairs yellowish-white when dry), the tomentum of crowded, closely overlapping, sessile hairs completely obscuring the bullate, papillose epidermis; veins and veinlets elevated and conspicuous; petioles 10–20 (–40) mm long, 1–3 mm thick, persistently tomentose; staminate aments (according to Muller) 5–6 cm long, pilose, loosely flowered, the anthers apiculate; pistillate flowers 2 or 3, scattered on a peduncle 1.5–3 cm long; fruit biennial, solitary or paired on a coarse peduncle 8–12 mm long and 4–6 mm thick, with numerous large prominent lenticels; cup hemispheric or deeper, 16–25 mm wide, 10–12 mm high, the margins thin, erect or sometimes (as in *Rose 2999*, the type of f. *incurva* Trel.) inrolled, the scales thin, appressed, canescent except the narrow brown glabrous margins, the tips deltoid and obtuse, or rounded, ciliate; acorns 15–18 mm long, 11–16 mm thick, rather broadly ovoid, light brown, about one-third included.

This is one of the largest and most beautiful oaks of the high pine and fir forests of Nueva Galicia. It is easily recognized by its large, dark-green leaves with aristate margins and white-tomentose under-surface. Known as *encino de hasta,* or *encino blanco,* it is often one of the dominant tree-species associated with the pines and firs.

Quercus castanea Née, An. Ci. Nat. 3: 276. 1801. *Quercus pulchella* Humb. & Bonpl. Pl. Aequinoct. 2: [38] 44. *pl. 88.* 1809. *Quercus circummontana* Trel. Mem. Nat. Acad. Sci. 20: 177. *pl. 356.* 1924. *Quercus rossii* Trel. Mem. Nat. Acad. Sci. 20: 179. *pl. 362.* 1924. *Quercus serrulata* Trel. Mem. Nat. Acad. Sci. 20: 179. *pl. 361.* 1924.

Rocky hills, mountainsides and ravines, stream valleys, often in mixed rather open woodland of pine and oak, sometimes in fir forest or in barrancas with other broad-leaved trees, or scattered in pastures or other disturbed habitats, frequent from 1500–2200 m, sometimes ascending to 2500–2700 m, or found as low as 800 m. Santa Teresa (*Rose 3398*); Sierra de Nayarit, La Ciénaga northwest of Mesa del Nayar (*Norris 14601*); Sierra Madre west of Bolaños (*Rose 3732*); Atengo (Cerro del Quelitán, *collector unknown*); Compostela, 800 m (*McVaugh 15306*); Cerro Sangangüey (*Breedlove 8059*); Amatlán de Cañas, Nayarit (*Reyes Parra 2070*); Mpio. de Tequila (El Joyanco, *M. Martínez 74*); Talpa de Allende (*McVaugh 14391*); Santa Mónica, in fir forest (*McVaugh 14134*); 25–30 km west of Ameca (*McVaugh 12169*); Autlán (*Wilbur 1440b*); Nevado de Colima (*McVaugh 13503, ?Ross 516*); Tapalpa (*McVaugh 20582, Iltis et al. 735*); Chiquilistlán (*M. E. Jones 445*!, type of *Q. serrulata*); Mazamitla (*McVaugh 13121*); Jocotepec (Trojes, *Puga 491*); Tepatitlán (*McVaugh 17396*); Tancítaro (*Leavenworth 543*); Coalcomán (Sierra Torrecillas, *Hinton 12746*); Pénjamo (Cerro el Fuerte, *Arroyo F. 2087*); Tiristiran (*?Gregg 797,* cited by Trelease as *Q. circummontana*). Southern Sonora, Sinaloa, western Durango, Nayarit, Jalisco, Michoacán (Sierra de San Andrés, *Ross 374,* type of *Q. rossii*), Guanajuato

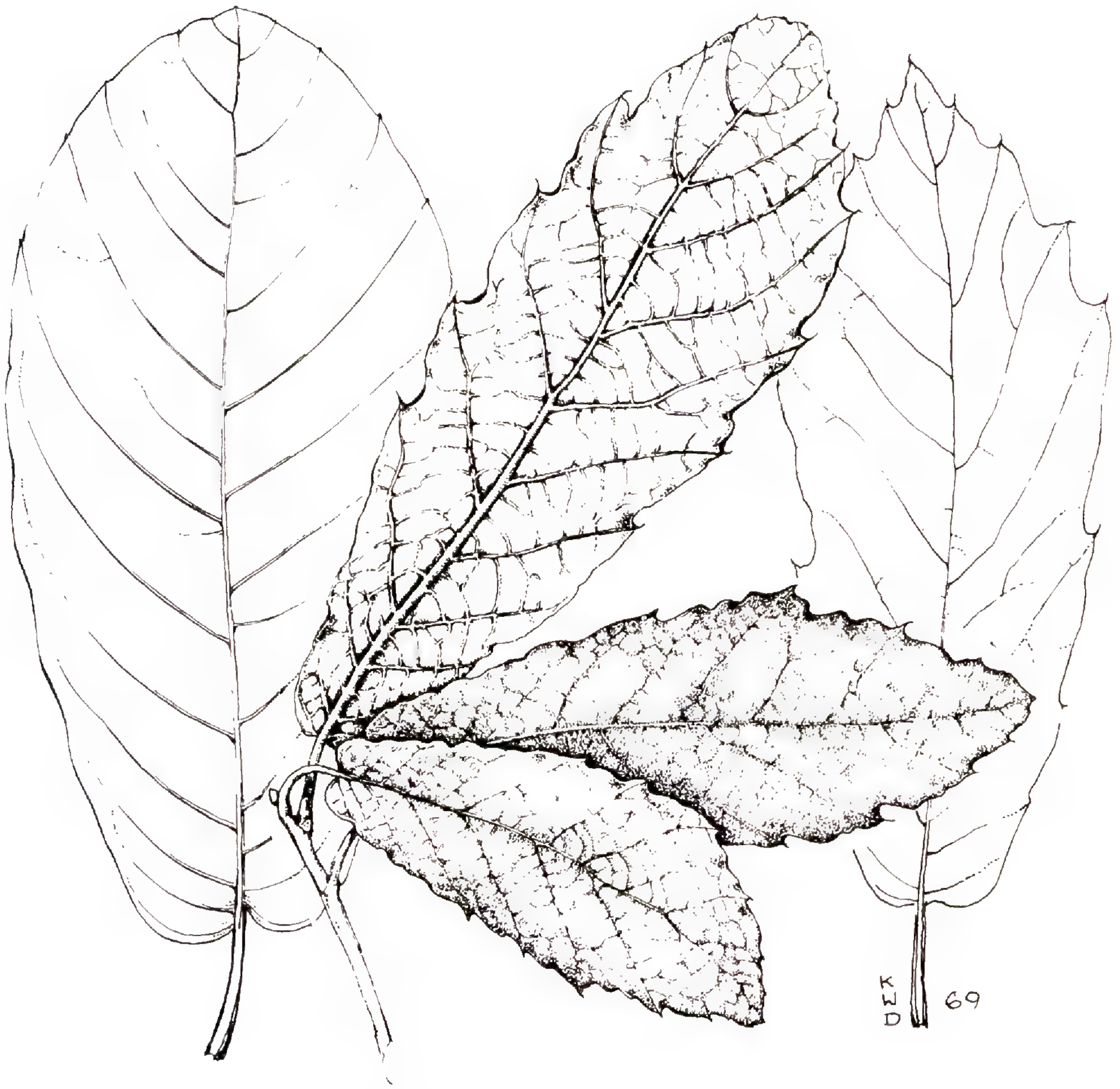

Fig. 4. *Quercus castanea*, × 1. Leafy twig, *Espinosa 870* (Michoacán); leaf, at left, *McVaugh 20663* (Jalisco); at right, *McVaugh 13268* (Jalisco).

(Guanajuato to Sta. Rosa, *Bonpland*, type of *Q. pulchella*), San Luis Potosí, Hidalgo (the type from Hidalgo or Guanajuato, Née), Morelos, Edo. de México, D.F., Puebla, Guerrero, Oaxaca, Veracruz (*Liebmann 3455*, type of *Q. circummontana*).

Trelease reported *Q. rossii* from "near Colima" (*Fernow 3*). This report, and those of the same species from "La Joya, Colima, etc.," presumably are based on collections from the uplands of the volcano of Colima, rather than from near the city of the same name.

A moderately large forest tree, often 10–15 m high, in favorable situations up to 20 m or more, the trunk 30–60 cm thick or up to 1 m; branchlets 1–2 mm thick, brownish-tomentulose when young, soon glabrescent and often by the end of the first season glabrous or nearly so, reddish brown to nearly black, usually with many pale lenticels 0.5–1 (–1.5) mm long; buds 2.5–4 mm long, ovoid or obscurely 4–5-angled, acute, brown, the scales short-ciliate; stipules 4–6 mm long, lanceolate, scarious, membranous, pilose, falling before the leaves are half grown or rarely persistent for a time on a terminal bud; leaves when young very densely pale-tomentose beneath, green or reddish and minutely stellate-pubescent above, often with short vermiform reddish

or amber glandular hairs as well; mature leaves noticeably pale or nearly white beneath, rigid and coriaceous, mostly oblanceolate, varying to elliptic-oblong, lanceolate, or obovate, (3.5–) 5–12 (–17) cm long, (1.2–) 2–3.5 (–7.5) cm wide, (1.7–) 2.5–3 (–3.5) times as long as wide, from narrowly acute to broadly rounded at apex, mostly cordate or subcordate at base but varying even on the same plant to abruptly or gradually rounded to the petiole; margins flat or slightly revolute, cartilaginous, rarely if ever completely entire, provided at least with very short mucro-like thickenings near the apex, usually with 2–4 (–12) slender spinelike projections on each side, or spine-tipped serrations, these sometimes coarse and up to 5 mm high or more; teeth always present in the distal third of the blade, often extending to the middle or well below that; veins 5–10 on each side, ascending, branching and anastomosing well within the margin, the stronger ones sometimes passing directly into the larger teeth, but the others often irregularly forked and sending short branches to the smaller marginal teeth; upper surface hard, somewhat lustrous, gray-green, evidently rugulose both fresh and dry, the secondary veins and sometimes also the primary ones, impressed; fine veinlets slightly convex, pale, contrasting with the green spaces between them; lower surface thinly gray-tomentose or somewhat yellowish, strongly bullate beneath the hairs, the bullae not or scarcely visible until the hairs are removed; veins conspicuously elevated and reticulate, only the smallest veinlets obscured by the hairs; petioles (3–) 5–12 (–20) mm long, 1–1.5 mm thick, tomentose to practically glabrous, often depressed between the two sides of the leaf-base; staminate flowers unknown; pistillate flowers 1–5, scattered along a tomentose or nearly glabrous peduncle up to 2 cm long, often much shorter; fruit annual, usually 1 or 2, nearly sessile or appearing terminal on a stout peduncle up to 5–6 mm long, 1.5–3 mm thick; cup hemispheric or slightly depressed, 12–15 mm wide, the scales thin, appressed, gray-pubescent with glabrescent brown edges and tips, tapering to broad blunt tips; acorns broadly ovoid, 10–12 mm long, 8–10 mm thick, half-included.

Quercus chihuahuensis Trel. Mem. Nat. Acad. Sci. 20: 85. *pl. 129.* 1924. *Quercus jaliscensis* Trel. Mem. Nat. Acad. Sci. 20: 86. *pl. 132.* 1924.

Rocky hillsides, ridges, stream-valleys, in open grassy woodlands with other oaks, in relatively dry uplands, 1800–2100 m, or in more humid forests in southern Nayarit and in the barrancas north of the Río Grande de Santiago, 750–1000 m. Mpio. de Valparaíso, near San Francisco (*Rzedowski 17645*); road to Calvillo, 37 km west of Aguascalientes (*Muller 9261, 9262, 9263*); near Colotlán, on the road to Plateado (*Rose 2685*!, type of *Q. jaliscensis; 2686*); 20 km north of Tepatitlán (*Rzedowski 15647*); Jalcocotán (*McVaugh 12134*); 15 km north of Compostela (*McVaugh 16552*); Santa María del Oro (Real de Acuilapilco, *Pérez C. 2006B*; Los Jazmines, *Pérez C. 2004*). Mountains of the Pacific slope, extending sparingly into the Central Plateau, Sonora, western Chihuahua (*Pringle 74!, 355!,* syntypes), western Durango and adjacent Sinaloa, southwestern Zacatecas, Aguascalientes, northwestern Jalisco, southern Nayarit.

Usually an open-grown, round-headed tree 6–10 (?–20) m high, the trunk 30 (–60) cm in diameter, with furrowed, scaling, soft gray bark; branchlets 2–4 mm thick, very densely and copiously tomentose with yellowish white or sordid yellow hairs, the tomentum persisting for one or even several seasons; buds 2–4 mm long, ovoid, obtuse, inconspicuous among the hairs, the scales pilose; stipules 5–8 mm long, pilose, scarious, soon deciduous, or the upper ones narrowly linear or filiform, persistent about the terminal buds; young leaves densely and softly gray-tomentose beneath, green but closely and softly stellate-pubescent above; leaves tardily deciduous,

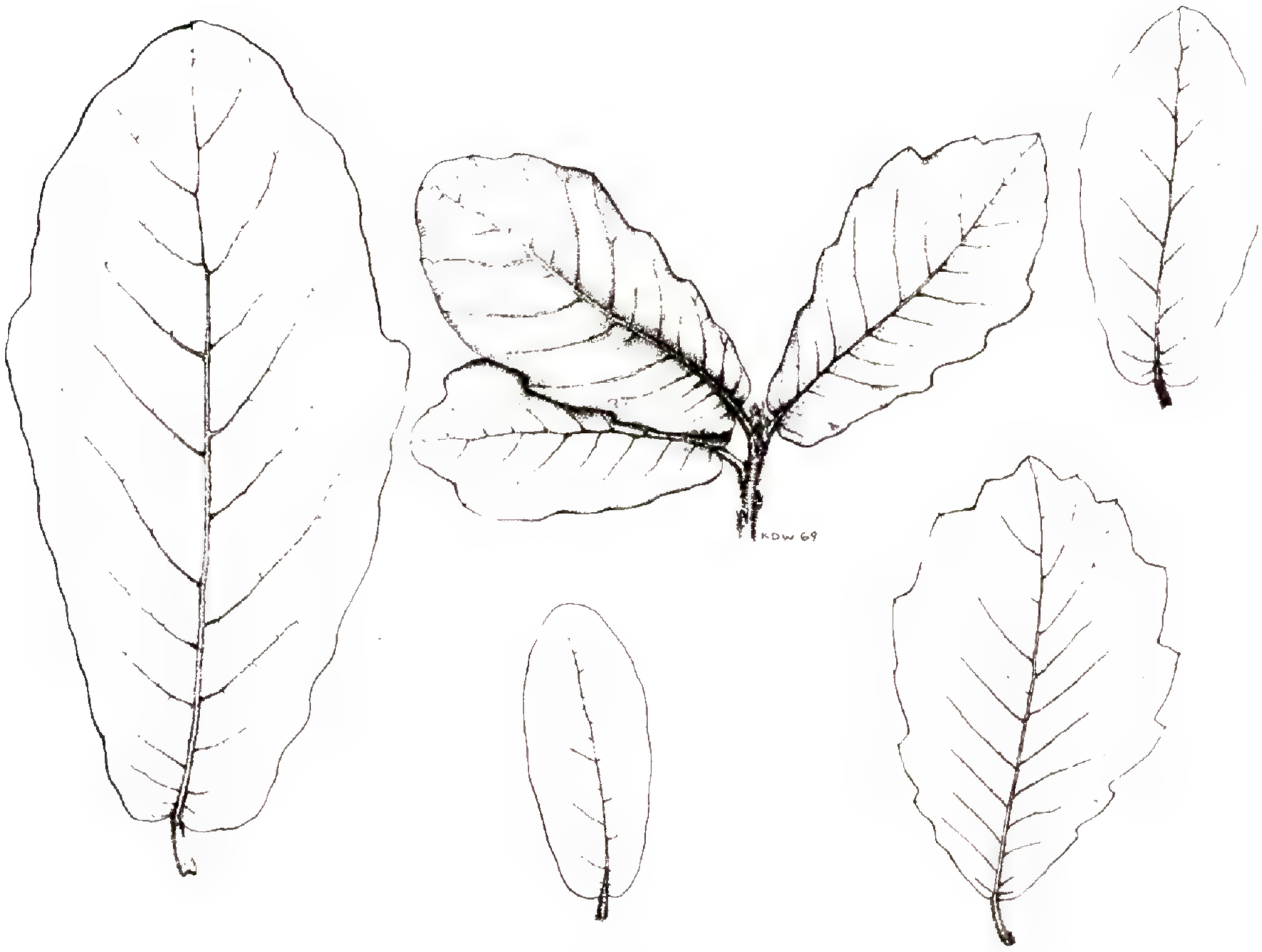

Fig. 5. *Quercus chihuahuensis*, × ½. Leafy twig, *McVaugh 16552* (Nayarit); leaves, left to right, *McVaugh 12134* (Nayarit), *Muller 3602B* (Chihuahua), *Rzedowski 15647* (Jalisco), *Muller 3602* (Chihuahua).

at maturity coriaceous, still softly and densely gray- or yellowish-pubescent, very variable in shape and size and in toothing, the blades obovate or oblong-obovate to elliptic, (3–) 5–12 (–22) cm long, (1–) 2–5 (–13) cm wide, 1.5–2.5 times as long as wide, obtuse or broadly rounded (usually), or sometimes subacute and short-mucronate at apex, usually rather broadly rounded or subcordate at base, entire to sinuate-dentate, or coarsely and obtusely serrate or lobulate-serrate; margins thickened, flat or revolute, the teeth if present up to 6–8 on each side, mostly tipped by a broad depressed mucro-like thickening; veins about 8–11 on each side, ascending, straight or arcuate, the upper ones passing directly into the teeth if these are present, the others much-branched and anastomosing; upper leaf-surface hard, green, thickly and persistently pubescent with erect, overlapping, 3–8-rayed hairs, or in old age glabrate; primary veins not impressed, the secondaries sometimes so, the veinlets forming a pale and slightly elevated network; lower surface paler, softly pilose, the pale green or glaucous epidermis papillose and minutely glandular-granular, otherwise smooth or somewhat bullate, partly but usually not completely obscured by the many, overlapping and tangled, erect, stipitate, 3–8-branched hairs; primary veins elevated and prominent, the secondaries often partly obscured by the hairs, the smallest veinlets not discernible except as depressed lines in the epidermis; petioles 2–5 (–12) mm long, 1–2 (–3.5) mm thick including the persistent tomentum; staminate aments 2–5 cm long, tomentose, the perianth pilose, the anthers 1.3 mm long, pilose; pistillate flowers few or several (as many as 10–12), scattered or clustered on a stout tomentose peduncle up to 5–6 cm long; fruit annual, solitary or paired, 1–3 usually developing, the cup hemispheric or deeper, 12–18 mm wide, the scales canescent-tomentose, thickened at base, the very numerous narrow, tapering, obtuse tips appressed; acorns ovoid, 12–15 mm long, half or more included.

Some populations of *Q. chihuahuensis* exhibit unusually great variation in leaf-form (e.g. Muller's collections from between Aguascalientes and

Calvillo), and it may be that plants with entire or nearly entire leaves show by their leaf-form some past intergradation with *Q. grisea.*

There seem to be consistent differences between *Quercus chihuahuensis* of northwestern Mexico, which ranges south to the northernmost part of our area, and the plant of southern Nayarit that is called *Q. chihuahuensis.* In the typical plant the leaves are often practically flat, and the upper leaf-surface is permanently rather densely stellate-pubescent. In the plant that occurs (at considerably lower elevations) in a somewhat isolated area in the hilly country around Tepic, the leaves are usually revolute, and often lose a part or all of the pubescence of the upper leaf-surface after they mature. Comparison of adequate series of flowering and fruiting material of the two populations is much to be desired.

Quercus coccolobifolia ["*coccolobaefolia*"] Trel. Mem. Nat. Acad. Sci. 20: 136. *pl. 258.* 1924. *Quercus endlichiana* Trel. Mem. Nat. Acad. Sci. 20: 141. *pl. 267.* 1924. *Quercus jonesii* Trel. Mem. Nat. Acad. Sci. 20: 136. *pl. 257.* 1924.

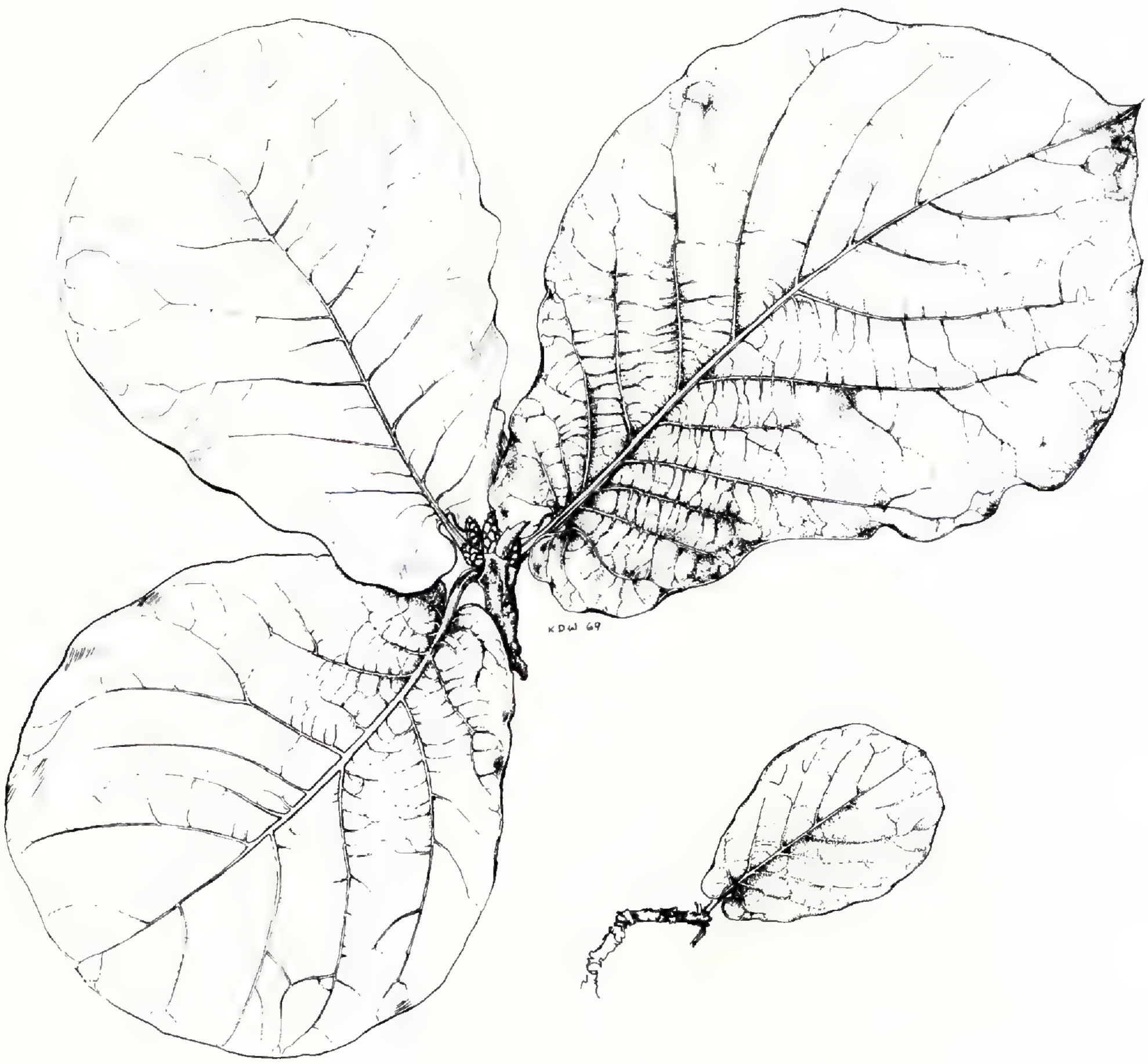

Fig. 6. *Quercus coccolobifolia,* × ½. Left to right, *McVaugh 21565* (Jalisco), *Rzedowski 14172* (Aguascalientes).

Sparse woodlands, stony hills with other oaks or with oaks and pines, a plant of relatively dry sterile mountain soils, 1750–2500 m. San Martín de Bolaños (*Rzedowski 26157*); "Sierra Fría," 25 km west of Presa Calles (*E. T. Hooper*); Sierra del Laurel (*McVaugh & Koelz 167*); C. García, Zacatecas (*M. Martínez 141*); between Jalpa and Tlaltenango (*McVaugh 25602*); San Sebastián (Real Alto, *Mexia 1760*); Ixtlán (*Reyes P. 2071*); 25 km west of Ameca, between La Estanzuela and Mixtlán (*McVaugh 12181*); San Miguel de la Sierra, ca 30 km west of Ayutla (*McVaugh 21565*); Tecolotlán (*M. Martínez 398*); Chiquilistlán (*Jones 446*!, type of *Q. jonesii*). Sonora, Chihuahua, western Durango (*Endlich 6*, type of *Q. endlichiana*), Sinaloa, Aguascalientes, Guanajuato (Sta. Rosa, *Bonpland 4269*, the type), Jalisco, San Luis Potosí. "Encino verde" (Nayarit).

Often a round-headed tree 6–15 m high, the trunk up to 50–70 cm thick with black, checked bark; branchlets 3–7 mm thick, purplish or reddish brown, with many small prominent lenticels, at first glandular-puberulent and stellate-pubescent, soon lustrous and nearly glabrous; buds (4–) 6–10 mm long, narrowly ovoid, acute, pale brown, the scales densely appressed-pilose and long-ciliate; stipules linear, up to 10–12 mm long, 1 mm wide, pilose, weakly persistent on the terminal buds; leaves when young thickly covered beneath by a mass of short reddish or amber-colored simple glandular hairs, a few stellate hairs interspersed, the upper surface minutely stellate, green; mature leaves very thick and rigid, broadly ovate to suborbicular or pandurate and usually very broadly rounded at tip, (7–) 10–19 cm long, (5–) 7–14 cm wide, sometimes as wide as long, often about 1.5 times as long as wide, the broad tip sometimes apiculate or aristate-acuminate, the thickened but not revolute margins usually undulate or puckered, otherwise entire, or occasionally bearing a few short projecting mucros near the tip of the blade; base of the blade cordate with narrow sinus and rounded auricles; veins about 5–8 on each side, straight and ascending half their length or more, then irregularly much-branched, the veinlets anastomosing near the margins; upper leaf surface at length hard and somewhat lustrous, at least sparingly minutely stellate, usually tomentulose on the base of the midvein, flat or the blade somewhat convex above, the veins and veinlets pale, slightly elevated; lower surface a little paler and yellower, often colored at least in patches by the persistent glandular-granular puberulence, otherwise essentially glabrous except for tufts of coarse pale hairs in the axils of the large veins; large veins pale and much elevated, the veinlets less conspicuous than on the upper surface, the epidermis pale, lustrous, papillose; petioles stout, (5–) 8–13 mm long, 2–4.5 mm thick at base, reddish, soon glabrous, or the concave longitudinal channel on the inner face persistently tomentose; staminate flowers unknown; pistillate flowers solitary or paired, coarsely pilose, essentially sessile, on stout peduncles 1–3 mm long, these almost always clustered at the tips of the branchlets; fruit annual, sessile, solitary or paired in each axil (thus several sometimes clustered about the tip of a twig); cup hemispheric, rather flexible, about 10 mm wide, pale brown, the closely appressed scales broadly rounded or obtuse, ciliate, appressed-pilose on the backs; acorn ovoid, 8 (–10?) mm long, half-included.

This is a relatively common species of dry woodlands in Nueva Galicia, often associated wtih *Quercus resinosa*, and always conspicuous where it grows because of the glossy green, broad stiff leaves tending to form clusters at the tips of thick stubby branchlets. The large-leaved form is the usual one in Jalesco, and ranges eastward to San Luis Potosí, but from Durango northward plants with smaller leaves 4–6 cm wide are not uncommon.

Quercus conspersa Benth. Pl. Hartw. 91. 1842. *Quercus nitida* Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 210. 1843, not *Q. nitida* Raf., 1838. *Quercus uruapanensis* Trel. Contr. U.S. Nat. Herb. 23: 191. 1922; Mem. Nat. Sci. 20: 143. *pl. 276, 277a.* 1924.

Steep forested slopes, in relatively open dry situations, often with pines and other oaks, 1200–1800 m, on the Pacific slope, little-known in Nueva Galicia. North-facing slope 3 km west of Autlán (*Wilbur 1701*); Tecalitlán (Los Corales, *Rzedowski 17366*; 25 km west of Jilotlán, *McVaugh 24523*). Southern Jalisco, Michoacán (Taretan and Uruapan, *Galeotti 121*!, type of *Q. nitida* Mart. & Gal., and of *Q. uruapanensis*; Ario de Rosales, *Muller 9240, 9241*), Guerrero, Estado de México, Oaxaca, Veracruz; Chiapas and Central America, the type from Guatemala (*Hartweg 617*).

Fig. 7. *Quercus conspersa.* Leafy twig, × ½, *Wilbur & Wilbur 1701* (Jalisco); twig with cups, × 1, *Rowell 3130* (Guerrero); leaves, × ½, left to right, *Rowell 3130, Deam 6087* (Guatemala), *Hinton 13195* (Michoacán), *Rzedowski 20807* (México).

A tree up to 10–15 m high or more, the trunk up to 50 cm in diameter or more, with checkered black bark; branchlets 1.5–2.5 (–4) mm thick, at first thinly stellate-pubescent, soon glabrescent, often nearly or quite glabrous the first season, reddish brown, with numerous pale lenticels; buds 3–4 mm long, ovoid, acute, the brown scales ciliate; stipules linear, pilose, deciduous before the leaves are full grown; young leaves pale-tomentose on the midvein beneath, the rest of the surface covered by a mass of short vermiform reddish or amber-colored glandular hairs, these interspersed with few coarser stellate hairs; mature leaves thick, coriaceous, deciduous, often yellowish beneath, elliptic to ovate or obovate, varying to lanceolate or oblanceolate, 8–15 (–21) cm long, (2.5–) 3.5–6 (–8) cm wide, 1.8–2.5 (–3) times as long as wide, the apex usually aristate, sharply acuminate, or sometimes acute or attenuate, the base rounded or obtuse, seldom subcordate; margins strongly cartilaginous-thickened but scarcely revolute, usually entire (as far as known in Nueva Galicia), or on leaves of vigorous shoots provided with 1–5 or more low teeth, or aristate, forwardly curving, coarse serrations on each side; large veins 7–12 on each side, ascending, commonly rather straight and nearly parallel at least near their bases, branching and anastomosing above the middle, those below the middle of the leaf often connected by several nearly straight veins approximately at right angles to them; upper leaf surface hard, somewhat lustrous, olive-green, essentially glabrous except at the base of the midvein, the large veins often impressed a little, the veins and veinlets elevated, pale, contrasting strongly with the green background; lower surface persistently glandular-granular and often strongly yellowed by the glands, otherwise essentially glabrous except for tufts of coarse stipitate hairs in the axils of the large veins, the epidermis green, papillose but otherwise smooth, the pale veins and veinlets much elevated but less strongly contrasting than those of the upper surface; petioles 8–15 (–30) mm long, about 1.5 mm wide near the blade, noticeably thickened and 2–3 mm thick at base, soon glabrous or the inner side persistently pubescent; staminate aments (according to Muller) 6–8 cm long, rather loosely flowered, the anthers (glabrous?), ellipsoid, apiculate; pistillate flowers 2–6, lateral and terminal on stout reddish glabrescent peduncles 5–20 mm long; fruit biennial, mostly solitary or paired, the peduncle 3–4 mm thick, the cup hemispheric or shallower, 15–18 (–22) mm wide, the margins coarsely inrolled; scales canescent, tightly appressed, the outer ones often hard and a little thickened at base, the middle ones with thin deltoid or obtuse tips; acorns ovoid to subrotund, 16 (–20) mm long, rounded apically, about one-third included.

In Nueva Galicia, and as far east as the State of Mexico, the prevailing form of *Quercus conspersa* has entire or essentially entire and often rather abruptly acute leaves, as in the type of *Q. uruapanensis*. Sometimes in an exceptionally vigorous specimen (e.g. Muller's no. 9241), some of the leaves may be coarsely serrate with long-aristate teeth, suggesting in this respect the leaves of *Q. acutifolia*. From Guerrero southeastward into Central America plants with narrow, long-acute, and prominently serrate leaves seem to become more abundant, although forms with broad entire leaves are found throughout the range of *Q. conspersa*.

Quercus crassifolia Humb. & Bonpl. Pl. Aequinoct. 2: [43] 49. *pl. 91.* 1809. *Quercus stipularis* Humb. & Bonpl. Pl. Aequinoct. 2: [41] 47. *pl. 90.* 1809. *Quercus brachystachys* Benth. Pl. Hartw. 91. 1842. *Quercus moreliana* Trel. Mem. Nat. Acad. Sci. 20: 130. *pl. 241.* 1924.

Moderately dry hillsides, rocky slopes, open forested mountains with pines and other oaks, or forming nearly pure stands, 1800–2800 m. San Sebastián (Real Alto, La Bufa, *Mexia 1603*); Autlán (Sierra de Manantlán, *McVaugh 10301, Wilbur 1899*). Hardly known from Nueva Galicia, but common from central Michoacan eastward. Jalisco, Michoacán (Morelia,

Fig. 8. *Quercus crassifolia.* Leafy twig, × ½, *Wilbur & Wilbur 1899* (Jalisco); leaves, × ½, left to right, *Muller 9142* (Hidalgo), *Rzedowski 23643* (Guerrero), *Iltis et al. 854* (Michoacán); twig with cups, × 1, *King 2092* (Oaxaca); hair from the lower leaf-surface, much enlarged.

Arsène 6681, type of *Q. moreliana*), Guerrero (Chilpancingo, *Bonpland*, the type), Edo. de México, Puebla, Hidalgo (Actopan, *Bonpland*, type of *Q. stipularis*), Querétaro, San Luis Potosí, Tlaxcala, Veracruz, Oaxaca; Chiapas and Guatemala (*Hartweg 618*, type of *Q. brachystachys*).

A rather short forest tree up to 10–12 or sometimes 20 m high, the trunk up to almost 1 m in diameter, with hard furrowed black bark; branchlets 2–5 mm thick, heavily tomentose, the hairs brownish yellow or at first purple, paling or blackening

and persisting for several years, the exposed bark dark reddish brown or black, with inconspicuous lenticels; buds narrowly ovoid, 4–6 mm long, pilose; stipules oblanceolate, 8–12 mm long, 2–4 mm wide, membranous, scarious, silky-pilose, deciduous before the leaves are full grown or persisting a short time about the terminal bud; young leaves and shoots very densely and thickly tomentose, the hairs often purple at first, soon yellowish, quickly deciduous from the upper leaf-surface; leaves tardily deciduous, at maturity very thick and rigid, dark shiny green above and tawny-tomentose beneath, obovate to oblong-obovate or elliptic, seldom ovate, (5–) 8–15 (–22) cm long, (2.5–) 3.5–8 (–14) cm wide, relatively broad, 1.5–2 times as long as wide, seldom longer, abruptly narrowed at the apex and there broadly rounded to acute, usually aristate and short-acuminate, sometimes obtusely pointed; blades more gradually narrowed toward base and there abruptly rounded to cordate; margins thickened and strongly revolute, usually standing well above the nearby veins on the lower surface, seldom entire, usually having 3–6 (1–8) low aristate teeth on each side above the middle, the teeth often sharp, 1–3 mm high, sometimes broad and low, then represented by aristae only, or on shoot-leaves much coarser, up to 1.5 cm high or more; veins 6–10 on each side with few or no strong intermediates, usually ascending at an acute angle, the lower ones branching and anastomosing well within the margin, the upper ones passing directly into the teeth if any, but even these often forking, and the branches terminating in adjacent teeth; upper leaf-surface hard, somewhat lustrous, becoming nearly glabrous except toward the base of the midvein, very rugose, the primary and secondary veins all impressed, the tiny veinlets coarse, paler than but not very different from the gray-green background in dry leaves; lower surface permanently but rather loosely brown-tomentose, the hairs erect, up to about 1 mm long, with short stipelike base and long, tangled branches obscuring the pale green, glandular and strongly bullate epidermis; primary veins elevated and conspicuous, the secondary and smaller veins partially or wholly concealed by the hairs; petioles tomentose, (5–) 8–15 (–30) mm long, 2–4 mm thick including the hairs; staminate aments 6–10 cm long, loosely flowered, the rachis tomentose, the yellowish cup-shaped perianth 2 mm high, glabrous below, the lobes pilose; anthers glabrous, 1.5 mm long; pistillate flowers usually 1 or 2, densely pilose, sessile or on very short stout peduncles hardly as long as the flowers; fruit annual or biennial, usually solitary or paired and nearly sessile, the peduncle 3–5 mm long and about as thick, or up to 1 cm long; cup 13–17 mm wide, hemispheric or the base a little prolonged, the thin brownish scales pale-pubescent with erect, thin appressed rounded tips; acorn ovoid, 15–18 mm long, 10–13 mm thick, light brown, glabrous, half-included or a little less.

From northwestern Durango to Chihuahua there is apparently a considerable population of what has been called *Quercus fulva* or *Quercus crassifolia,* in which the hairs of the lower leaf-surface are densely matted and sessile, not substipitate as in *Q. crassifolia* proper. This may represent a distinct taxon.

Specimens resembling a small-leaved form of *Q. crassifolia,* with obovate leaves 3–6 cm long, have been collected on the Sierra del Laurel, at about 2500 m (*Rzedowski 14107*).

Quercus crassipes Humb. & Bonpl. Pl. Aequinoct. 2: [32]37. *pl. 83.* 1809. *Quercus confertifolia* Humb. & Bonpl. Pl. Aequinoct. 2: [47]53. *pl. 94.* 1809. *Quercus crassipes* [var.] *angustifolia* Humb. & Bonpl. Pl. Aequinoct. 2: [33]38. *pl. 84.* 1809. *Quercus mexicana* sensu Trel. Mem. Nat. Acad. Sci. 20: 173. 1924, not of Humboldt & Bonpland. *?Quercus mexicana* f. *glabrata* Trel. Mem. Nat. Acad. Sci. 20: 174. 1924. *Quercus colimae* Trel. Mem. Nat. Acad. Sci. 20: 174. 1924.

Grassy openings, stream-valleys, forested mountainsides with pines, or with *Alnus* and other broad-leaved trees, 2000–2600 m, the fruit maturing

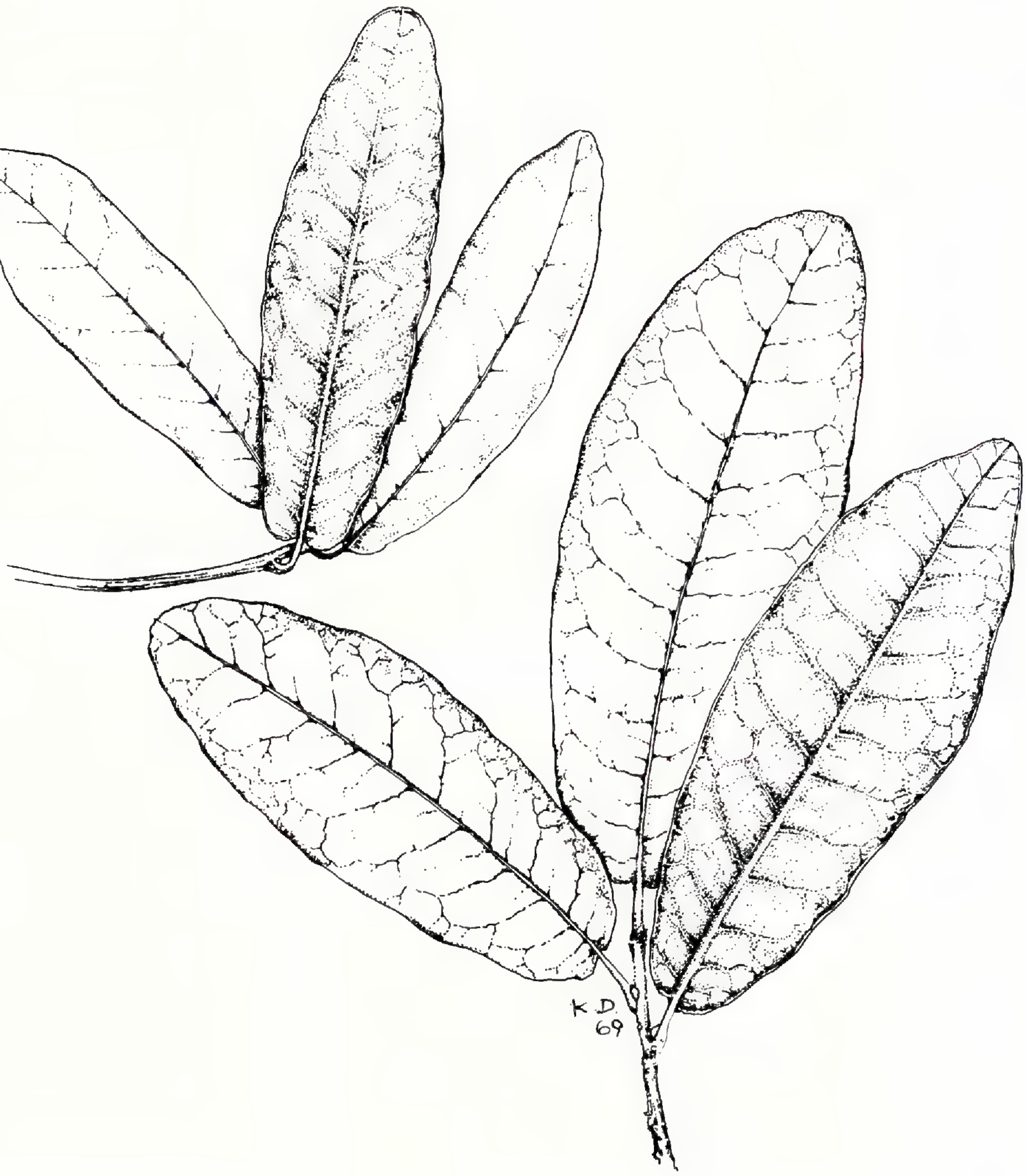

Fig. 9. *Quercus crassipes*, × 1. Left to right, *McVaugh 13514*, *McVaugh 14154*. Both from Jalisco.

in November. Near San Miguel de la Sierra, 40–60 km southwest of Ayutla, bordering open areas of bunch-grass (*McVaugh 14154, 14155*); Nevado de Colima (*McVaugh 13514*; "Cerro Grande," *Burnett*, type of *Q. colimae*); Tapalpa (*Iltis 736*); "Guadalaxara" (*?Galeotti 118*, type of *Q. mexicana* f. *glabrata*); Coalcomán (*Hinton 13695*); Cerro Patamban (*Rzedowski & McVaugh 653*). Jalisco, Michoacán (Ario, *Humboldt & Bonpland*, type of *Q. crassipes angustifolia*), Guanajuato (Santa Rosa, *Humboldt & Bonpland*, the type; between Guanajuato and Santa Rosa, *Humboldt & Bonpland*, type of *Q. confertifolia*), Quéretaro, Morelos, Edo. de México, D.F., Hidalgo, Tlaxcala, Puebla. "Encino chililllo" (Michoacán).

A tall tree often 12–20 m high or more, with trunk up to 1 m in diameter; branchlets 1–2 mm thick, densely yellowish-tomentose when young, at maturity thinly pubescent, dark reddish brown to almost black, with few or many small pale lenticels;

buds 2.5 mm long, ovoid, reddish brown, nearly glabrous, the scales ciliate; stipules lance-linear, falling before the leaves are half-grown, 4–6 mm long, membranous, pubescent; leaves rigidly coriaceous, markedly different on the two faces, narrow and entire, narrowly elliptic or a few lanceolate or oblanceolate, (2.5–) 4–9 cm long, (0.7–) 1–2 (–3) cm wide, (2.7–) 3–4.5 times as long as wide, often about equally narrowed to the rounded or subacute, aristate apex, and the subcordate or merely abruptly rounded base; margins revolute, very narrowly callose-thickened; veins 10–17 on each side, widely diverging or some of them standing almost at right angles to the midvein, curving forward and anastomosing well within the margin, sometimes forming evident interconnecting arches; upper leaf-surface hard, somewhat lustrous, gray-green or dark green, essentially glabrous at maturity or the midvein tomentose near base, the large veins impressed, the fine veinlets forming a pale elevated reticulum on a green background; lower surface yellowish-gray, covered by a persistent but rather loose tomentum that may completely obscure the surface features including the small veinlets, or may be so thin that the strongly bullate epidermis may be discerned through the hairs; petioles 2–6 mm long, 1–1.2 mm thick at base, reddish and somewhat tomentose; staminate aments about 2 cm long as far as known, pilose, the anthers glabrous, apiculate, 1.3 mm long; pistillate flowers 1 or 2, on a peduncle 5 mm long or less, 2–2.5 mm thick; fruit biennial, solitary or paired, the peduncles 5–12 mm long, 3–5 mm thick or more, often much thicker than the branchlets from which they arise; cups hemispheric or with straight sloping sides and usually much infolded margins, 15–20 mm across, the scales tomentose, somewhat thickened toward the bases, the obtuse deltoid tips sometimes glabrescent; acorns short-ovoid, 10–16 mm long, 10–12 mm thick, thinly puberulent, about one-third included.

Quercus depressipes Trel. Mem. Nat. Acad. Sci. 20: 90. *pl. 144.* 1924. Grasslands, rocky hills with scattered shrubs and small trees, 2260–2500 m in Nueva Galicia. 20 km west-southwest of Valparaíso (Puerto de la Paja, *Rzedowski 17546*); 15 km southwest of Huejúcar (La Mesa de María de León, *McVaugh 12000*); Juanacatic, El Plateado (*G. Guzmán H.*); Ciudad García (*Muller 9270*). A plant of the high grasslands, mostly west of the Central Plateau; western Texas, Chihuahua, Durango (Sierra de la Candela, at 3000 m, *Endlich 3*, the type), southern Zacatecas, northern Jalisco.

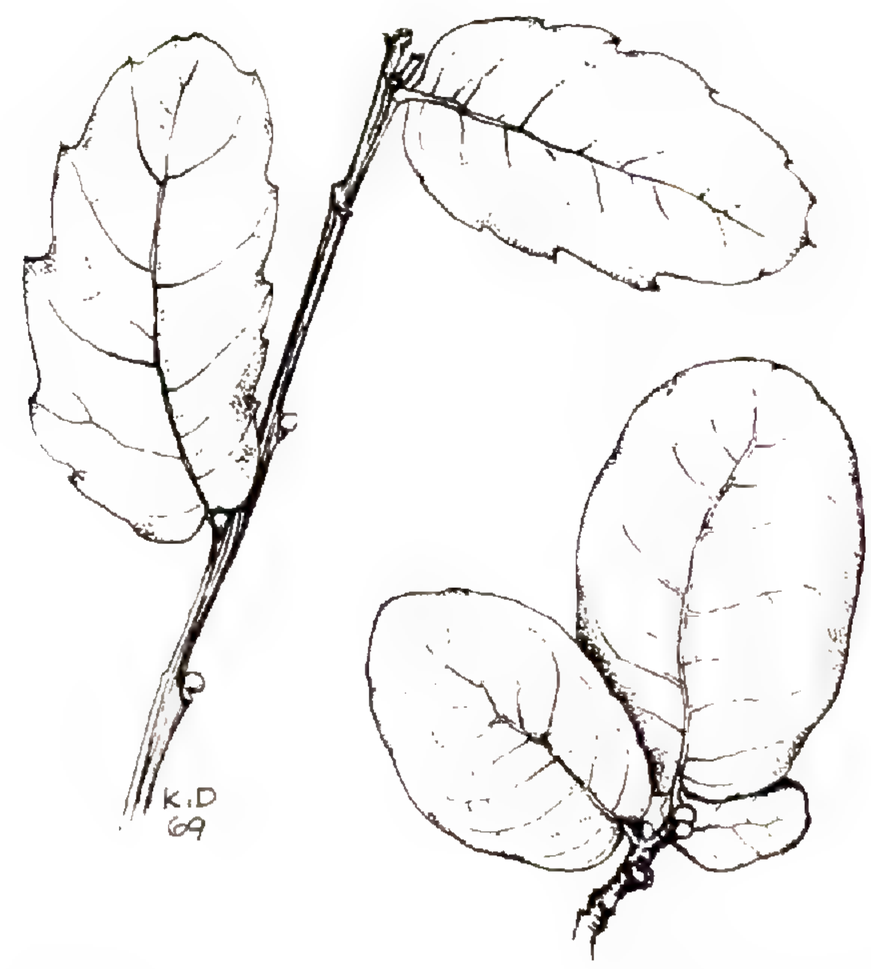

Fig. 10. *Quercus depressipes*, × 1. Left to right, *Rzedowski 17546* (southern Zacatecas), *McVaugh 12000* (northern Jalisco).

Shrubs 1–3 m high or less, growing singly, or stoloniferous and thicket-forming; whole plant glabrous or essentially so, the young growth tomentulose, the leaves sometimes with a few stellate hairs on the midvein; branchlets 1–2 mm thick, reddish brown to gray-brown, with few inconspicuous lenticels; buds up to 1.5–2.5 mm long, short-ovoid or subglobose, reddish brown, the scales ciliate; stipules soon falling, seldom present on mature branchlets, 3–5 mm long; leaves pale bluish green, sub-evergreen, thick and coriaceous, (5–) 15–25 (–35) mm long, (4–) 10–20 (–25) mm wide, 1.5–2 times as long as wide, oblong or elliptic to slightly obovate, broadly rounded to subacute at apex, cordate or subcordate at base; margins flat or slightly revolute, seldom quite entire, usually with 1–3 (–6) low callose-tipped or mucronate teeth above the middle on each side, or the teeth occasionally extending almost to the base of the blade; veins 4–7 on each side, with a few intermediates, arcuate-ascending, somewhat raised (including the small veinlets) on both surfaces, obviously branching and anastomosing well within the margin, even those terminating in the larger teeth often branched and irregular; leaf-surfaces not very different from one another, the upper lustrous, with thick-walled refractive epidermal cells conspicuous, the lower dull, minutely granular-puberulent and obscurely papillose, the refractive lustrous epidermal cells conspicuous chiefly along the veinlets; petioles 1–2 mm long or rarely longer, 1 mm thick, rose-colored with a glaucous bloom, strongly depressed in the cordate leaf-bases; staminate catkins (according to Trelease) scarcely 20 mm long, rather closely flowered, the glabrous anthers little exserted; pistillate aments rather consistently 2-flowered; fruit annual, solitary or paired on a glabrous or stellate peduncle 7–25 mm long, 0.6–1 mm thick; cups 8–10 mm broad, hemispheric or the base somewhat prolonged, the scales thickened and densely gray-tomentose at base, the apices deltoid, obtuse, reddish brown, ciliate, rather closely appressed; acorns 12–15 mm long, 8–10 mm broad, ellipsoid to ovoid, rounded at apex, glabrous, brown, one-fourth to one-half included.

Quercus deserticola Trel. Mem. Nat. Acad. Sci. 20: 79. *pl. 113.* 1924.

Rocky, dry hills of basalt or rhyolite, with sparse cover of shrubs and other small trees, 2000–2800 m. Jocotepec (Sierra de Tecuán, Trojes, *Puga 679*; without locality, *Puga 673*); Cerro Grande de Cujaruato, southwest of La Piedad (*Rzedowski & McVaugh 499, 500, 559*). Eastern Jalisco, Michoacán (Tiristiran, *Gregg 796*), southern Guanajuato (Acámbaro, *Rzedowski 25377*; Cerro Culiacán, *Puga 299*), Querétaro, Hidalgo; the type came from "Desierto" (?*Uhde 309*). "Encino chico.'

A tree up to 8–10 m high; branchlets 1.5–4 mm thick, densely and copiously yellow-tomentose, the tomentum persisting for two or more seasons, the bark gray-brown with rather large lenticels; buds 2–4 mm long, ovoid, obtuse, inconspicuous among the hairs, the scales pilose; stipules 6–9 mm long, scarious, pilose, filiform, persistent around the terminal buds, otherwise soon deciduous; leaves probably tardily deciduous, densely tomentose when young, at maturity rigidly coriaceous, yellowish-pubescent, oblong-oblanceolate to lanceolate or narrowly obovate, (3–) 5–11 cm long, 1.5–3 (–5.5) cm wide, 2–3 times as long as wide, obtuse to acute at apex, gradually narrowed and then abruptly rounded or cordate at base, entire to sinuate-dentate, or coarsely and obtusely serrate or lobulate-serrate; margins thickened and strongly revolute, the teeth if present 1–5 on each side, callose-tipped or mucronate, asymmetric, ascending, up to 5–6 mm high; veins 6–9 on each side, ascending, ending in the teeth if any, otherwise branching and anastomosing near the margins; upper leaf-surface hard, dark green, slightly lustrous, persistently stellate-pubescent, evidently rugulose, the veins and larger veinlets impressed, the smallest veinlets forming a pale, slightly elevated network; lower surface paler, densely and softly pilose, the glaucous, papillose and minutely glandular-granular epidermis otherwise smooth or slightly bullate, covered but not obscured by the many yellowish, overlapping and tangled, erect, stipitate, 5–8-branched hairs; primary and secondary veins elevated and usually

Fig. 11. *Quercus deserticola,* × 1. Leafy twig, *Rzedowski 25352* (Guanajuato); leaves left to right, *Puga 673, 679* (both from Jalisco).

plainly seen through the hairs, the smallest veinlets visible only as depressed lines in the epidermis; petioles 2–6 (–12) mm long, 1.5–2 mm thick including the persistent tomentum; staminate aments with tomentose axis, and coarsely pilose perianth and anthers; fruit annual, solitary or paired, on stout tomentose peduncles up to 2.5 cm long, 2 mm thick; cup hemispheric or deeper, 15–25 mm wide, 10–16 mm deep, often narrowed at the mouth, the scales strongly convex-thickened on their canescent bases,

the pale brown, glabrescent, narrowly tapering obtuse tips appressed and sometimes incurved, 2–2.5 mm long; acorns broadly ovoid, 12–18 mm long, 10–15 mm wide, half or more included.

As may be seen by comparing the descriptions, this species is very similar to *Quercus chihuahuensis*, but usually has narrower leaves, which are markedly rugulose. The tomentum of the leaves and branchlets is a little more yellow in *Q. deserticola*, and the leaves of that species, on the average, have slightly fewer veins and teeth than do those of *Q. chihuahuensis*. In the latter the leaf-margins are nearly flat (except in the population about Tepic), whereas in *Q. deserticola* they are markedly revolute. The range of *Q. deserticola*, as far as known, does not overlap that of *Q. chihuahuensis*. If more complete series of both species were available, it might be possible to assess the extent of their relationship more accurately. Perhaps they should be treated as ecotypes or subspecies of one species.

Quercus eduardii Trel. Contr. U.S. Nat. Herb. 23: 189. 1922; Mem. Nat. Acad. Sci. 20: 121. *pl. 219*. 1924. *Quercus oligodonta* v. Seemen, Bot. Jahrb. 29: 96. 1900, not *Q. oligodonta* Saporta, 1879.

Hills and ridges in high grassland or open woodland, rocky slopes and mountainsides, with pines and other oaks, sometimes the dominant species in rather dry oak forest or with *Acacia*, *Mimosa*, and *Opuntia*, 1500–2600 m. Southern Durango (*Rose*, 13 Aug 1897); Santa Teresa (*Rose 2224*); Huejuquilla (*McVaugh 17754*); Mezquitic (*Rzedowski 17713*); Ciudad García (*M. Martínez 145*); 25 km southwest of Huejúcar (*McVaugh 12002*); Plateado to Colotlán (*Rose 2693, 3655*); San Martín de Bolaños (*Rzedowski 26158*); Bolaños to Guadalajara (*Rose 3024*); Nochistlán (*M. Martínez 410*); Sierra del Laurel (*McVaugh & Koelz 173*); Paso de la Troje (*McVaugh 16796*); Cerro de los Gallos (25 km south of Aguascalientes), where the most abundant oak (*McVaugh 17083*); 20 km southeast of Encarnación de Díaz (*Rzedowski 15659*); San Sebastián (Mexia 1738); Talpa de Allende (*McVaugh 20341*); 20 km west of Ayutla (*McVaugh 21573*); 8 km northwest of Cuautla (*Rzedowski 15063*); 10–12 km northwest of Los Volcanes (*McVaugh 12192*); La Estanzuela, 25 km west of Ameca (*McVaugh 12183*). Durango (*Palmer 956*!, the type), southwestern Zacatecas, northern Nayarit, northern and western Jalisco, Aguascalientes, Guanajuato, Querétaro, San Luis Potosí.

A round-headed open-grown tree 5–10 m high, with trunk 20–45 cm thick, and black, checkered, rough bark; in more exposed places a shrub 1 m high or less, or sometimes a forest tree 15–20 m high with trunk 50–60 cm thick; branchlets 1–1.5 mm thick, when young (like the young leaves) tomentose and thickly beset with golden or amber-colored glandular hairs, in age pale tomentulose or thinly pubescent, dark reddish brown or nearly black, with numerous pale lenticels; buds ovoid, acute, 1.5–3.5 mm long, brown, lustrous, the scales ciliate; stipules 4.5–6 mm long, membranous, pilose, oblanceolate, falling in April and May before the leaves are full grown, or rarely persistent for a time on the terminal bud; leaves small, green on both sides but usually noticeably paler beneath, rigidly coriaceous, oblong-elliptic to ovate-lanceolate, occasionally oblanceolate or obovate, 2–4.5 (–6.5) cm long, (0.6–) 1–2 (–3) cm wide, 1.5–3 (usually 2) times as long as wide, often acute or subacute at apex

Fig. 12. *Quercus eduardii,* × 1. Leafy twig (above), *McVaugh 16796* (Jalisco); below, *Muller 9320* (Querétaro); leaves, left to right, *McVaugh 20341, 17083* (both Jalisco).

(but other leaves on the same plant, or all leaves on some plants, obtuse or rounded), cordate or subcordate at base; margins flat or slightly revolute, the heavy pale cartilaginous border often as thick as the main lateral veins; blades seldom completely entire, usually denticulate, dentate, or serrate with 1–5 widely spaced aristate teeth on each side, entire only near the base or sometimes to the middle; veins 5–8 on each side, ascending, branching and anastomosing well within the margin, even those terminating in the teeth seldom unbranched, often zigzag near the tips, and sometimes unequally divided with the smaller branch passing into the marginal spine; upper surface hard, glossy (a feature often noted by collectors), dark green or gray-green, essentially glabrous or persistently stellate especially near base, the larger veins pale and noticeable, all the veins and veinlets slightly convex above, the veinlets (under a lens) pale and contrasting with the green spaces between them; lower surface paler and more uniformly green, less lustrous, uniformly but rather sparsely beset with small crumpled tuftlike pale stellate hairs, often bearing tufts of larger hairs in the vein-axils, the larger veins more prominent than on the upper surface, the veinlets less so; petioles 2–4 (–7) mm long, pale or reddish, 1–1.3 mm thick, thinly tomentose or at length glabrescent; staminate aments 1.5–3 cm long, the rachis densely pilose; perianth 2 mm long, broadly campanulate, nearly glabrous, the lobes long-ciliate; anthers glabrous, 1–1.2 mm long; pistillate flowers 1 (–2), on a peduncle 1–4 mm long; fruit annual (apparently seldom produced in quantity, very seldom collected), nearly sessile, the cup about 10 mm in diameter, 6 mm deep, with rather straight sides and narrow base, the scales thin, appressed, rounded, at first tomentulose, finally glabrescent, brown; acorn ovoid, about 10 mm long, half-included.

This is the common small-leaved black oak in the part of our area north of the Lerma-Santiago basin. In this part of Nueva Galicia it replaces *Quercus castanea,* which it somewhat resembles. In western Jalisco, as between Talpa and Ayutla, the two species grow together over a limited range, and some hybridization may occur. Trelease did not explain why he called this particular oak "*eduardii,*" but presumably the name was given in honor of Edward Palmer (1831–1911), who collected the type near Durango in 1896.

Quercus elliptica Née, An. Ci. Nat. 3: 278. 1801. *Quercus botryocarpa* Trel. Mem. Nat. Acad. Sci. 20: 150. *pl. 295.* 1924. *Quercus chiquihuitillonis* Trel. Mem. Nat. Acad. Sci. 20: 139. *pl. 264.* 1924. *Quercus exaristata* Trel. Mem. Nat. Acad. Sci. 20: 140. *pl. 266.* 1924. *Quercus langlassei* Trel. Mem. Nat. Acad. Sci. 20: 138. *pl. 263.* 1924. *Quercus peradifolia* Warb. Kew Bull. 1939: 92. 1939.

Humid forests, mountainsides, barrancas, with pines and other oaks, with *Carpinus* and other broad-leaved trees, or in savannas with *Curatella* and *Byrsonima,* sometimes the only oak in the pine forest, or forming almost pure stands, 700–1700 m, fruiting June to October, the staminate flowers produced in March and April. Pedro Paulo, 3 Aug 1897 (*Rose 1971*!, type of *Q. botryocarpa; Rose s.n.*!, type of *Q. exaristata*); between Jalcocotán and Tepic (*McVaugh 12127, 18821*); Santa María del Oro (*McVaugh 23527*); Mazatán (*Rzedowski 17719, 17915*); San Sebastián (*Mexia 1823, 1910*); Talpa de Allende (*McVaugh 21424*); Autlán (*McVaugh 13958*); Tecalitlán (*McVaugh 15022*); Hda. Coahuayula (*Emrick 113*). Widely distributed in the mountains of the Pacific slope: Eastern Sinaloa, Nayarit, Jalisco, Michoacán (Chiquihuitillo, *Langlassé 212*!, type

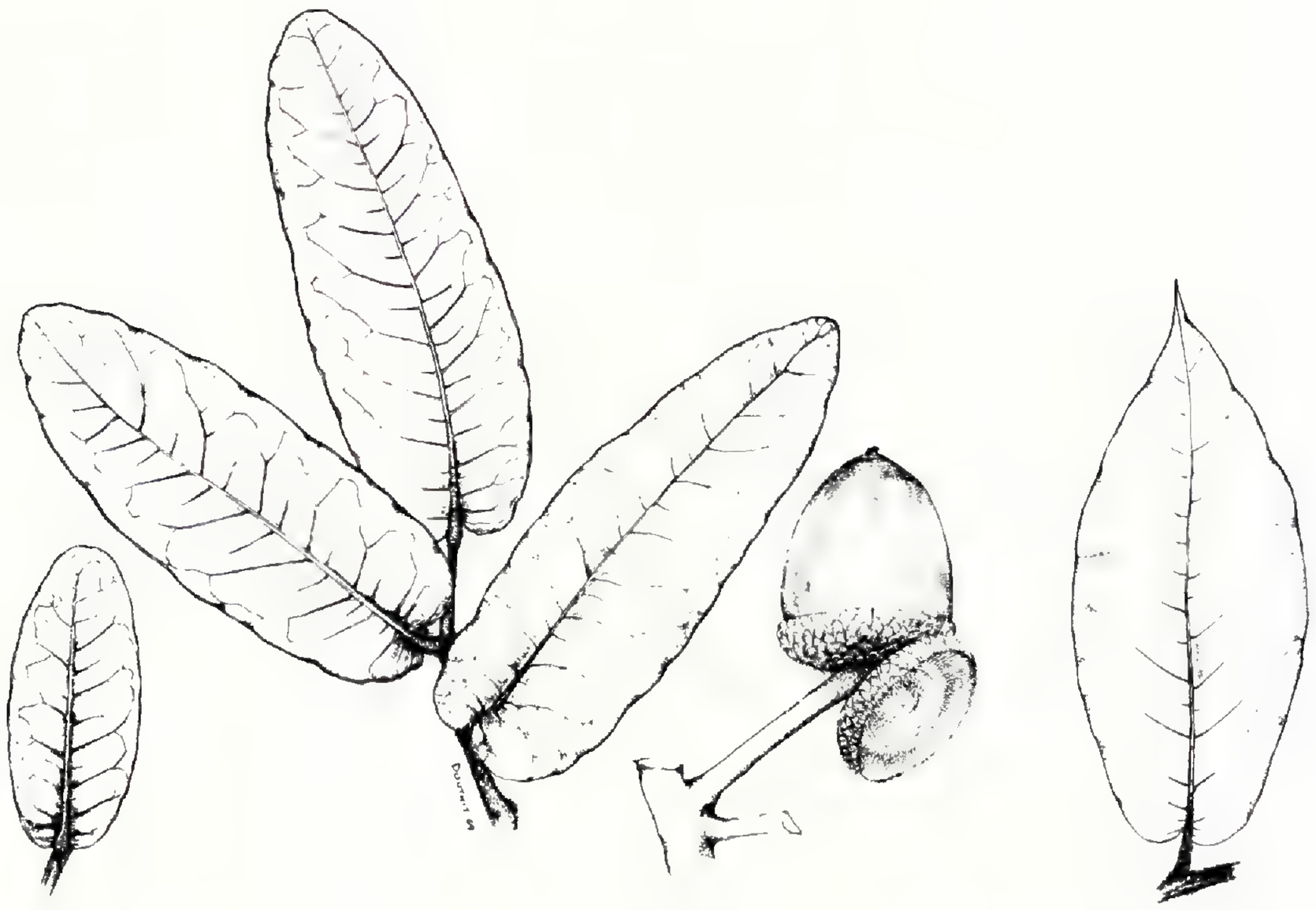

Fig. 13. *Quercus elliptica.* Leafy twigs, × ½, left to right, *McVaugh 14218, 20342, 20335*; twig with cups, × 1, *McVaugh 15022.* All from Jalisco.

of *Q. chiquihuitillonis*), Guerrero (*Langlassé 1006*!, type of *Q. langlassei*), Edo. de México (Temascaltepec, *Hinton 6062*, type of *Q. peradifolia*), Oaxaca, Veracruz; Central America. The type, collected by Née, came from Hidalgo (between Ixmiquilpan and Zimapan), or from Guerrero (near Tixtla).

Often a large tree, up to 20 m high with trunk 1 m in diameter, or in open woodland forming a round-headed tree 8–12 m high with trunk 30–50 cm in diameter; branchlets 2–3 mm thick, densely sordid-tomentose, the tomentum persisting for 1 or 2 years, the bark when exposed reddish brown to black, with inconspicuous lenticels; buds seldom prominent, 3 mm long, ovoid, dark brown; stipules 6–8 mm long, linear or oblanceolate, membranous, scarious, ciliate, deciduous when the leaves are half-grown; leaves when young closely but loosely pale-tomentose beneath with small, stellate, deciduous hairs, the upper surface green, densely pubescent with minute, pale or purple stellate hairs; mature leaves rigidly coriaceous, nearly the same color on the two sides when dry, or a little paler beneath, elliptic to lanceolate or oblanceolate, entire, (4–) 7–10 (–15) cm long, (1.5–) 3–5 (–7) cm wide, 2.5–3.3 times as long as wide, mostly broadly rounded or obtuse at tip, varying (often on the same plant) to emarginate or to acute, if acute seldom aristate; base usually cordate-auriculate, the margins sometimes merely abruptly rounded to the petiole; margins pale, cartilaginous-thickened and slightly revolute; larger veins 10–15 on each side, leaving the midvein at a wide angle (usually 45° or more), branching and anastomosing well within the margins, the veinlets usually forming interconnecting arches evident to the unaided eye; intermediate veins smaller and much shorter than the principal ones, half as many or fewer, some or all of them usually nearly at right angles to the midvein; upper leaf-surface essentially glabrous except at the base of the midvein, hard and somewhat lustrous, evidently furrowed by the impressed, pale, parallel veins, the veins and veinlets forming fine convex lines, paler than the green areoles between them; lower surface paler and more yellowish green, at length essentially glabrous but with fine tufted hairs persisting in the vein-axils and often along the midvein; veins elevated, pale and conspicuous, the small veinlets less conspicuous than on the upper surface, the epidermis green, papillose; petioles 3–6 (–8) mm long, 2–3 mm thick including the persistent tomentum; staminate aments 5–14 cm long, loosely flowered, the axis rather sparingly pilose; perianth sessile or pedicellate, broadly cup-shaped, 1.3–1.5 mm high, with broad, ciliate lobes; anthers oblong-ellipsoid, 1–1.3 mm long, glabrous; pistillate flowers solitary or paired or up to 4 or 5, on stout tomentose peduncles 1–2 cm long or less; fruit 1–3, biennial, on peduncles becoming 2–3 mm thick; cup 12–17 mm wide, saucer-shaped or flat, 4–7 mm high, the thin, appressed, obtusely triangular scales canescent except for the brownish shiny tips and margins, the inner ones erect, ciliate; acorn broadly ovoid, truncate at base, 13–15 mm long, 11–13 mm thick, thinly pubescent, only the base included.

The leaves of this species are similar in shape to those sometimes found in *Q. aristata*, in which the blades are entire and without terminal spine. Ordinarily, however, the two species may be distinguished by the angle at which the primary veins leave the midvein, by the relative prominence of the small veinlets, especially those near the margins, and by the more abundant tangled tomentum of the young twigs in *Q. elliptica*. The two species grow not far apart in southern Nayarit, but their habitats are rather different. *Q. elliptica* is primarily a plant of well-drained humid mountain forests, whereas *Q. aristata* is found in open woodland or on hillside savannas, in poorer drier soils.

Quercus excelsa Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 174. 1854.

Steep wooded humid mountainsides, barrancas in fir-forest on steep south- and west-facing slopes, in pine forest or with other oaks and *Carpinus, Tilia,* and *Podocarpus,* 1400–2250 m. San Sebastián (Arroyo de Santa Gertrudis, *Mexia 1541*); Talpa de Allende (Sierra de Cuale, southwest of Talpa, *McVaugh 14272, 14354, 14362*; 15–18 km south of Talpa, *McVaugh 21454*); between San Miguel de la Sierra and Santa Mónica (*McVaugh 14149*); Autlán (above Ahuacapán, *Rzedowski 14558*).

Fig. 14. *Quercus excelsa,* × ½. Leafy twig, *McVaugh 14149*; leaves, upper right, *McVaugh 21454*; below, left to right, *Rzedowski 14558, McVaugh 14362, 14362.* All from western Jalisco.

Western Jalisco; apparently the same species in Veracruz (Matlaluca, *Liebmann 3477*, the type).

A tall forest tree, up to 30 m high or more, with straight trunk up to 1 m diameter and pale gray bark in flat thin plates; branchlets 1.5–3 mm thick, strigose at first, soon glabrescent, gray-brown, with few and inconspicuous or rather numerous lenticels; buds ovoid, obtuse, pale brown, 2–3 mm long; stipules 3–5 (–10) mm long, sparingly strigose or glabrous, persistent only about the terminal bud; young leaves strongly reddened, nearly glabrous above from the first, copiously pubescent beneath with very flat, pale, 5–10-rayed hairs 0.3–0.5 mm wide; mature leaves firm or coriaceous, deciduous, green to strongly whitened beneath, glabrescent, elliptic to lanceolate or oblanceolate, (5–) 10–22 cm long, (2–) 3.5–8 cm wide, 2.5–3.5 times as long as wide, acute to acuminate but ultimately blunt and mucronate at tip, narrowed from the middle or somewhat above to the rounded or subcordate (seldom acute) base; margins thickened but scarcely revolute, somewhat undulate and puckered, sometimes entire or nearly so, often sinuate-dentate to sharply serrate with up to 8–10 mucronate teeth, up to about 1 cm high, on each side; basal one-third or one-half of the blade entire, or the teeth occasionally extending nearly to base; upper leaf-surface hard, slightly lustrous, essentially glabrous except the base of the midvein, flat (the large veins not or scarcely impressed), the veins and veinlets convex above; large veins 10–15 or more, ascending, the upper ones mostly terminating in the teeth; lower surface waxy-glaucous, obscurely papillose, glabrous or sparingly stellate, or with stiff simple hairs on the large veins; veins pale and elevated, the small veinlets less conspicuous than on the upper surface; petioles 5–10 mm long, reddish-brown, plano-convex, glabrous and glaucous or pubescent on the inner face, thickened and darker toward base, where 1.5–2.5 mm thick; flowers and fruit of the Jalisco plant unknown; acorns according to Trelease elongated-ovoid, 40–50 mm long, covered at the base only by the shallow, saucer-shaped cup 35 mm in diameter.

Our plant is vegetatively much like some forms of *Quercus germana* Schlecht. & Cham. Linnaea 5: 78. 1830, a species of the Atlantic slope from Tamaulipas to Hidalgo, Puebla and Veracruz (the type from near Jalapa, *Schiede*). In *Q. germana* the teeth are often concentrated in the distal third of the blade, and the petioles are mostly 3–5 mm long only. The acorns and cups are larger than almost any of those known in the oaks of western Mexico; the hemispheric cups with thickened tomentose scales are 2.5–3.5 cm in diameter, and the blunt, ovoid acorns 2.5–3 cm long, one-third to one-half inclosed.

Included with *Mexia 1541* are an acorn and some cups, evidently of a white oak, but surely not of *Q. germana*. The cups are about 1.5 cm across, and the acorn about 1.7 cm long.

Quercus frutex Trel. Mem. Nat. Acad. Sci. 20: 82. *pl. 120.* 1924.

Arid hillsides, open rocky shrub-covered mountainsides, sparse woodlands with *Bursera* and *Ipomoea* or with other oaks, on limestone or other rocks, 1500–2400 m. Above Ixtlahuacán de los Membrillos (*Eliane Meyer 664*). Jalisco, Edo. de México (Valle de Bravo, *Matuda 26935*), D. F. (*Bourgeau 68*!, the type), Hidalgo, Tlaxcala.

Usually a rhizomatous shrub 1–2 m high or often less, forming large clumps or thickets; occasionally a small tree, up to 5–7 m high; branchlets 1–2 mm thick, densely sordid-tomentose, glabrescent after 1 or 2 seasons, dark reddish brown or almost black, the lenticels small and rather inconspicuous; buds brown, 1.5–2.5 mm long, ovoid, obtuse, the scales ciliate-margined; stipules subulate, 5–7 mm long, pilose,

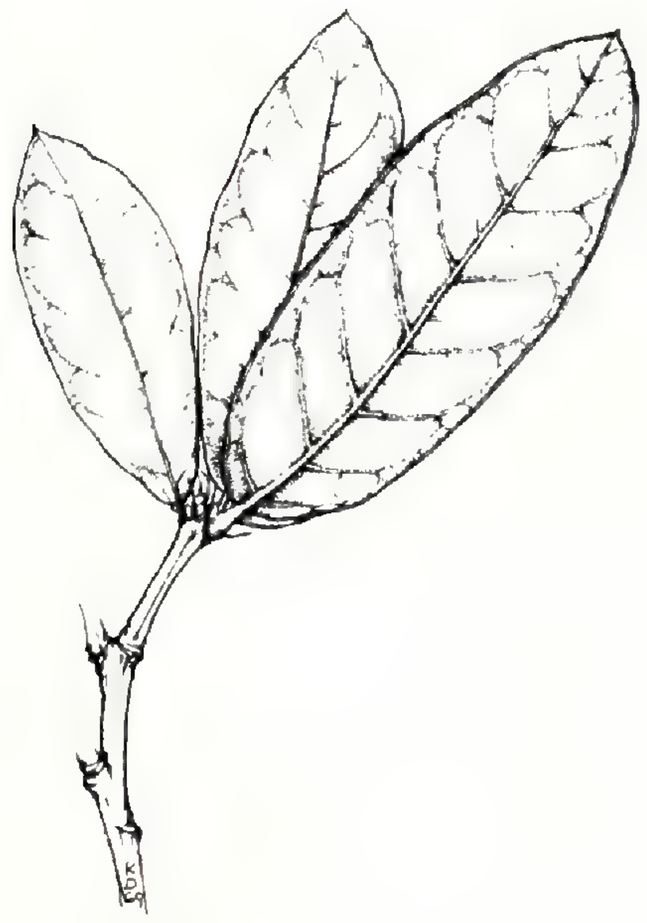

Fig. 15. *Quercus frutex*, ×1. *Eliane Meyer 664* (Jalisco).

weakly persistent at least as shreds for most of the first season; leaves thick and leathery, bicolorous, yellowish-tomentose beneath, (1–) 2–4 (–5.5) cm long, (0.3–) 0.7–1.5 (–2.2) cm wide, 2.5–3.5 times as long as wide, elliptic-oblong to ovate-lanceolate or oblanceolate, abruptly rounded to subacute and often very shortly mucronate at apex, rounded to subcordate at base; margins but very slightly cartilaginous-thickened, strongly revolute, entire or irregularly undulate, or seldom (especially on leaves of vigorous shoots) bearing 1–3 coarse teeth above the middle on each side; veins 5–8 on each side, arcuate-ascending, freely anastomosing, forming interconnecting arches near the margins; upper leaf-surface hard and faintly lustrous, persistently and copiously stellate-pubescent, uniformly gray-green or slightly yellowish, the small veinlets inconspicuous, the large veins impressed; lower surface tomentose, the somewhat yellowish-white hairs quite covering and hiding all except the larger veins, or often forming a sparse tomentum through which may be seen the glaucous and obscurely papillose epidermis; hairs of this surface mostly erect or nearly so, not matted, consisting of several ascending-arching branches united at base into a short but definite trunk; petioles tomentose or finally glabrescent, 1.5–5 mm long, 0.5–1.5 mm thick; staminate aments 5–15 mm long, pilose, the perianth 1.5 mm long with narrow acute pilose lobes, the anthers glabrous, 0.8–1.5 mm long; pistillate flowers few, scattered along a rachis up to 1 cm long or more, the fruit annual, usually nearly sessile, solitary or paired, the cup hemispheric or shallower, 12–14 mm wide, the scales gray-tomentose, the outer ones a little thickened at base, the tips appressed, brown, narrowly triangular and obtuse, cottony-ciliate; acorns ovoid, 12–15 mm long, 8–10 mm thick, about one-third included.

This plant may readily be confused with *Q. microphylla* Née, to which Trelease compared it. In general appearance the two species are much alike, but the distinctive difference in the hairs of the lower leaf-surface generally enables one to separate them without difficulty. The ranges of the two species are adjacent but scarcely overlapping; *Q. microphylla* is more a plant of the edges of the southern part of the Central Plateau, and *Q. frutex* is apparently more nearly restricted to the axis of the Sierra Volcánica Transversal.

Quercus fulva Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 183. 1854. *Quercus rosei* Trel. Mem. Nat. Acad. Sci. 20: 137. *pl. 260.* 1924.

Fig. 16. *Quercus fulva.* Leafy twig at lower left, × ½, adapted from Trelease, American Oaks, *plate 235,* an isotype at C; leafy twig with cups, × ½, *Norris 14534* (northern Nayarit); peduncle with cups, × 1, *Norris 14534*; detached leaf, × ½, and detached hair, much enlarged, from lower leaf-surface, *Muller 9048* (Durango).

Open woodland, rocky hills and ravines in oak or oak-pine forest, 2000–2500 m. In the "Sierra Madre" near Santa Teresa (*Rose 3458*!, type of *Q. rosei; Rose 2223, 3449, 3457,* all collected in fruit, 12–13 Aug 1897); Sierra de Nayarit, La Ciénaga, northwest of Mesa del Nayar (*Norris 14534*). The type, *Seemann 1973*!, came from the "Sierra Madre," i.e.

probably along the road near the Sinaloa-Durango border, between Mazatlán and the City of Durango, where Seemann collected in the winter of 1849–1850. Muller has collected the same species, presumably at or near the type-locality (*Muller 9048*).

A tree up to 8–10 m high, the trunk 20–30 cm thick, with furrowed gray bark; branchlets 2.5–4 mm thick, densely and tightly yellow-tomentose, the tomentum persisting for several years; buds ovoid, short-acute, pubescent, 3–5 mm long; stipules linear, scarious, deciduous as the leaves mature or weakly persistent on the terminal bud; leaves probably deciduous, at maturity rigid, gray-green above and yellow- or brownish-pubescent beneath, broadly elliptic to obovate, suborbicular, or flabellate, (6–) 8–15 cm long, 4–8 (–12) cm wide, 1.4–1.9 times as long as wide (or on shoots about as wide as long), rather abruptly narrowed to a broad, rounded or subacute, usually aristate or short-acuminate and aristate tip, more gradually incurved below the middle to the cordate or abruptly rounded base, strongly revolute, entire or (in one known collection, from Durango) with 6–11 low broad aristate teeth at the sub-truncate apex; veins 6–10 on each side, strongly ascending, branching and anastomosing in the distal third of their length, or passing directly into the teeth if these are present; upper leaf-surface hard and faintly lustrous, drying pale green, essentially glabrous except for the tomentose bases of the larger veins, the primary and secondary veins evidently impressed; small veinlets coarse, forming a pale elevated network on a pale green background; lower surface copiously and persistently glandular-puberulent, strongly yellowed by the glands and by the dense covering of brownish-yellow, stiff, 15–20-branched, overlapping but not tangled, sessile hairs that practically hide the smaller glandular hairs, and the bullate epidermis; primary and secondary veins elevated, easily visible through the hairs; petioles (5–) 10–20 mm long, 2–3 mm thick including the hairs; staminate flowers unknown; pistillate flowers 1–3, usually paired at the end of a very stout tomentose peduncle 2–5 (–15) mm long, 3 mm thick; fruit biennial, solitary, paired or in 3's, the peduncles up to 1.5 cm long, 3–5 mm thick, the cups nearly hemispheric or shallower, 13–18 mm wide, 6–9 mm deep, the margins inrolled almost to the bottom, the brown scales pale-pubescent, hardly at all thickened at base, with broad appressed tips and thin usually erose or splitting margins; acorns broadly ovoid or almost round, 9–12 mm long, 8–11 mm wide, light brown, about half-included.

Trelease published a photograph of an isotype (*Seemann 1973*, from the Copenhagen herbarium) that shows clearly the leaf-form, and the characteristic hard pubescence that distinguishes *Quercus fulva* from forms of *Q. crassifolia* with similar leaf form. Warburg (Kew Bull. 1939: 90. 1939) notes that *Q. fulva* differs from *Q. crassifolia* in its "much thinner rich yellow tomentum and long pointed buds." He cites *Ortega 973*, from "Sinaloa or Tepic."

Quercus gentryi C. H. Muller, Am. Midl. Nat. 27: 474. 1942.

Mountainsides, wooded hills and ravines, often in relatively dry open forest with pines and other oaks, 1450–2350 m. Mezquitic (*Rzedowski 17665*); Sierra del Laurel (*McVaugh & Koelz 162*); Juchipila (Cerro de Piñones, *Rzedowski 18260*); San Martín de Bolaños (*Rzedowski 26207*); Cerro Sangangüey (*Breedlove 8056*); Talpa de Allende (*McVaugh 20337*); Santa Mónica (*McVaugh 14146*); 25–30 km west of Ameca (*McVaugh 12171*); Autlán (*Wilbur 2062*); Nevado de Colima (*McVaugh 11795*); Mazamitla (*McVaugh 13202*); Tuxcueca (Cerro de García, *León Navarro 2073*); Mpio. de Jocotepec (Trojes, *Puga 686*); Tepatitlán (Cerro Gordo, *McVaugh 17522*); Cerro Grande de Cujaruato, La Piedad (*Rzedowski &*

Fig. 17. *Quercus gentryi.* Leafy twigs, × 1, left to right, *Rzedowski 18260* (southern Zacatecas), *McVaugh & Koelz 162* (Aguascalientes); bullate lower leaf-surface, much enlarged.

McVaugh 571); Cerro Patamban (*Rzedowski & McVaugh 590*). Durango, Sinaloa (*Gentry 5686*!, the type), Aguascalientes, Nayarit, Jalisco, Michoacán, Guanajuato, chiefly known from the southwestern borders of the Central Plateau. "Encino avellano cimarrón" (Jalisco); "Encino chililllo" (Jalisco).

A tree up to 12–15 m high, seldom more, the trunk 30–50 cm or rarely 1 m in diameter; branchlets 1–1.5 mm thick, closely pale stellate-pubescent, glabrescent and becoming nearly or quite glabrous the second year, dark reddish brown, with numerous small pale lenticels; buds 2–4.5 mm long, ovoid, acute, brown, the scales ciliate; stipules linear-subulate, pilose, deciduous before the leaves are grown or 1 or 2 of them weakly persistent about the terminal buds; young leaves green and finely stellate-pubescent above, thinly and more closely stellate-pubescent beneath (more densely so along the midvein), and densely covered with very short, vermiform, reddish or amber-colored glandular hairs; mature leaves entire, willow-like, bright green, paler and a little yellower beneath, thin but firm, very tardily if at all deciduous, narrowly elliptic to lanceolate or oblanceolate, (3–) 6–10 (–18) cm long, (0.8–) 1.5–2.5 (–4) cm wide, (3–) 4–5 (–7) times as long as wide, acute to acuminate to attenuate at the mucronate or aristate tip, abruptly rounded (seldom subcordate) to merely obtuse at base; margins with pale cartilaginous thickening, not or scarcely revolute, without teeth as far as known but usually puckered or undulate and sometimes appearing crenate because of the alternately flat and curved portions; veins 10–15 on each side in addition to several short intermediate ones, widely divergent, leaving the midvein at an angle between 45° and 80°, branching and anastomosing well within the margins, the veinlets forming small interconnecting arches; upper leaf-surface hard, dark green and glossy, nearly glabrous but with scattered very small pale stellate hairs, the veins and veinlets slightly convex, paler than the rest of the surface but not much so; lower surface yellow-green, the epidermis bullate and papillose, at maturity essentially glabrous except for lines of soft pale short-stipitate hairs along the midvein and the bases of the large lateral veins; glandular hairs often sparingly persistent; large veins forming a pale elevated ladder-like network, the smallest veinlets visible only as thin impressed lines between the bullae; petioles 2–6 (–10) mm long, 1–1.5 mm thick at base, usually at length glabrescent; staminate aments 3 cm long, rather densely flowered, tomentulose; perianth cup-shaped, stipitate, the lobes thinly pubescent; anthers 1.5 mm long, glabrous, ellipsoid; pistillate flowers 1–3, on stout pubescent peduncles 3–5 (–10) mm long, 1.5 mm thick; fruit biennial, solitary or paired, on an enlarged peduncle 2–3 mm thick, with prominent lenticels; cup hemispheric or deeper, about 15 mm wide, 10 mm high, the margins (according to Muller) thickened and inrolled; scales light brown, thin, appressed, narrow and rounded; acorns (according to Muller) broadly ovoid, 1 cm wide and scarcely longer, light brown, two-thirds or more included.

The narrow, willowlike leaves of *Quercus gentryi* are sometimes almost exactly the same shape as those of *Quercus salicifolia* Née. In the latter, however, the lower leaf surface is flat and somewhat shining (not bullate), glabrous at maturity or with tufts of hairs in the axils of the main veins and sometimes along the midvein. Although in some localities in western Jalisco the two species grow only a few kilometers distant from one another, their habitats are quite different. *Q. gentryi* is a plant of dry shallow soils of interior uplands, whereas *Q. salicifolia* is an inhabitant of the steep, more humid forests in the mountains on the Pacific slope, at considerably lower elevations.

Quercus glaucescens Humb. & Bonpl. Pl. Aequinoct. 2: [25] 29. *pl. 78.* 1809. *Quercus cuneifolia* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 182. 1854, not *Q. cuneifolia* Raf., 1838. *Quercus pinalensis* Trel. Contr. U.S. Nat. Herb. 23: 179. 1922; Mem. Nat. Acad. Sci. 20: 46. *pl. 28.* 1924.

Humid, tropical deciduous or subdeciduous forest, steep mountainsides, barrancas, sometimes with pines and other oaks, 500–1000 m.

Fig. 18. *Quercus glaucescens.* Leafy twig, × ½, *Gentry & Gilly 10662* (Nayarit); hairs from the lower leaf-surface ca. × 40 (upper left, small superficial hairs; lower right, hair from the vein-axil), all from *Rowell 2992* (Guerrero).

Between Tepic and Jalcocotán (*Gentry & Gilly 10662*). Little known in western Mexico. Sinaloa (Colomas, *Rose 1757*; Cerro de Pinal, *Seemann 1456*, type of *Q. cuneifolia* Liebm. and *Q. pinalensis*); southern Nayarit; Michoacán (25 km southwest of Arteaga, *Rzedowski 26637*); well-known in Guerrero (between Venta de la Mojonera and Acaguizotla, *Humboldt & Bonpland*, the type), Oaxaca and Veracruz. "Encino blanco," "encino roble," "encino prieto."

A forest tree up to 20 m high, the trunk 15–40 cm in diameter with scaly gray bark, the youngest twigs and leaves sparingly or very densely and closely stellate and with some stiff simple hairs, the hairs persisting chiefly in tufts in the axils of the foliar veins; branchlets 1.5–3 (–4) mm thick, brown or reddish brown, lustrous, with many pale lenticels often 1–2 mm long; stipules 3–6 mm long, at first strigose, persistent on the terminal buds only, or all caducous; buds plump, short-ovoid, the scales ciliate; leaves deciduous, pale but not waxy-glaucous beneath, coriaceous, oblanceolate to obovate or elliptic, (8–) 12–20 (–27) cm long, (3–) 5–10 (–13) cm wide, 2–3 times as long as wide, often obtuse (or rounded), obtusely acuminate, or

obtusely toothed at apex, tapering to a narrow base from the middle or above, the very base of the blade sometimes cuneate-attenuate, often rather abruptly rounded, seldom subcordate; margins thickened and slightly revolute, sometimes entire, but in most leaves coarsely sinuate-dentate, with 1–6 more or less well-defined blunt ascending teeth above the middle of the blade; veins about 7–10 on each side, ascending, nearly straight at base, branched in the distal third (often nearly equally forked), the upper ones often terminating in the foliar teeth and callose-thickened at apex, but even these usually with strong arching lateral branches near the tips; upper leaf-surface hard, lustrous, finely reticulate with pale convex veins and veinlets; lower surface pale green or yellowish green when dry, reticulate but the primary and secondary veins a little more prominent than those of the upper, the epidermis lustrous and evidently papillose (as seen at 25×–50×), densely pubescent with very small, sessile, brownish, flat stellate hairs, often finally glabrous or nearly so, but the larger vein-axils provided with conspicuous tufts of yellowish, sessile hairs with several arching-ascending branches; petioles reddish, lustrous, much thickened near base, 4–10 mm long, 2–3 mm thick, adaxially flattened; staminate catkins (according to Trelease) "5–6 cm long, glabrescent, rather closely flowered, the rounded glabrous anthers exserted"; pistillate catkins "equally long, verticillately several-flowered"; fruit annual, solitary and short-pedunculate or clustered at the tip of a peduncle 1–2 cm long; cups 2–2.4 cm broad, 8–11 mm high, broadly cup-shaped or more open, thin-margined, tomentose, the basal and middle scales globose- or umbonate-thickened, the inner ones with thin triangular appressed obtuse tips 1.5–2 mm long; acorns ovoid, rounded and apiculate at apex, 20–30 mm long, 13–18 mm thick, about one-third included.

Quercus glaucoides Mart. & Gal. Bull. Acad. Brux. 10, pt. 1: 209. 1843. *Quercus baldoquinae* Trel. Mem. Nat. Acad. Sci. 20: 53. *pl. 43.* 1924. *Quercus conjungens* Trel. Mem. Nat. Acad. Sci. 20: 55. *pl. 48.* 1924. *Quercus harmsiana* Trel. Mem. Nat. Acad. Sci. 20: 54. *pl. 45.* 1924.

Dry open woodlands, hillsides in tropical deciduous forest with *Bursera, Ceiba,* and cacti, or with other oaks or oaks and pines, often in pastures or other disturbed habitats, in western Mexico chiefly in the basin of Lake Chapala and in the valley of the Río Tepalcatepec, 900–1600 m,

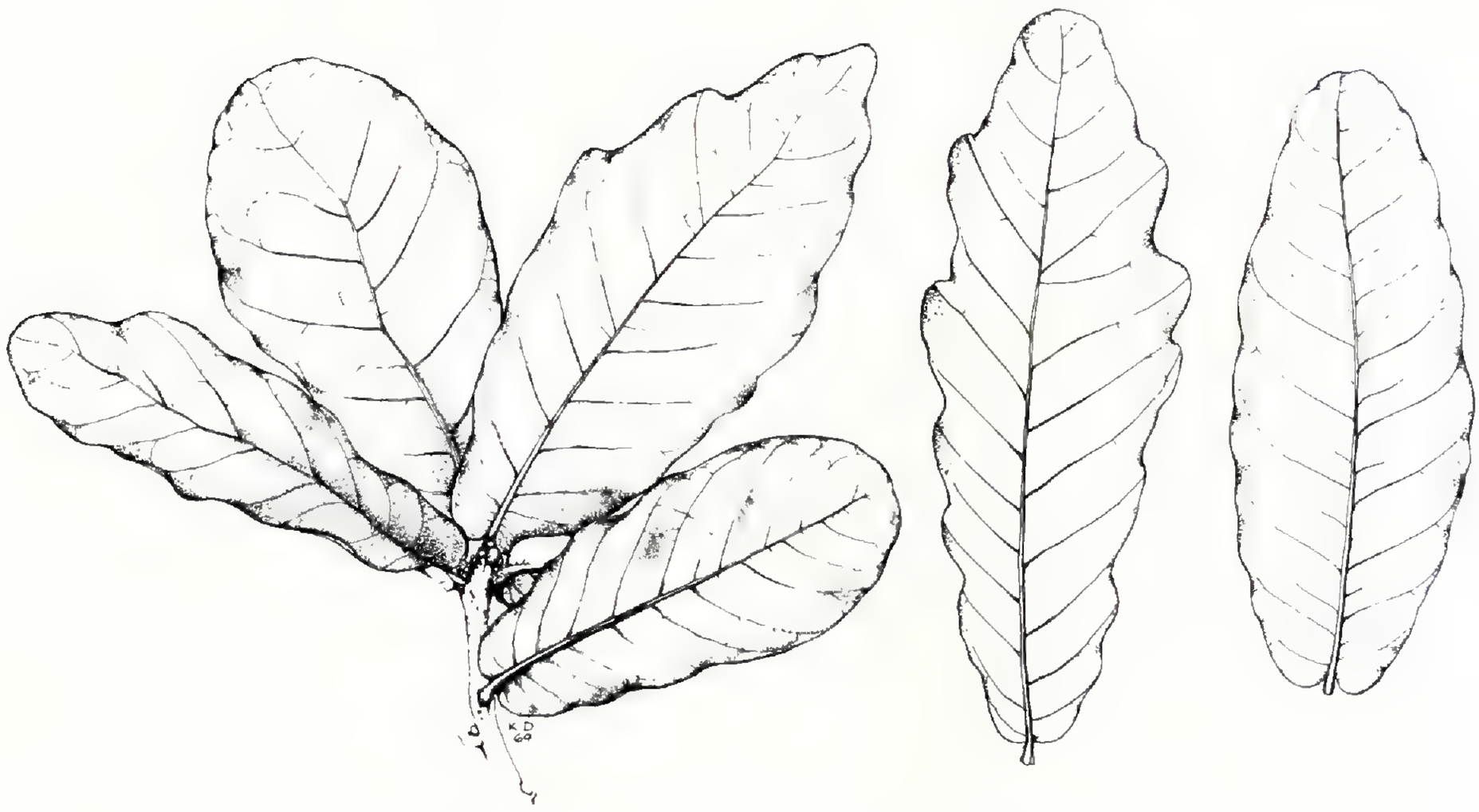

Fig. 19. *Quercus glaucoides,* × ½. Leafy twig, *Rzedowski 17373* (Jalisco), pro max. part.; leaves, left to right, *Espinosa 862* (Michoacán), *McVaugh 22667* (Michoacán).

the fruit ripening in September and October, the staminate flowers produced in May. Cerro de García, Tuxcueca (*León Navarro 2060*); Tecalitlán (Mata de Bule, near Los Corales, *Rzedowski 17484*); Jilotlán (Sierra del Coral, *Rzedowski 16630*); 12 km west of Zamora (*Muller 9061*); 8 km northwest of Aguililla (*McVaugh 22667*). Southern Jalisco, Michoacán (Cerro Baldoquin, Ario de Rosales, *Endlich 1354,* type of *Q. baldoquinae; Endlich 1356,* type of *Q. harmsiana*), Guerrero, southern Guanajuato (Acámbaro, *Pringle 8841*!, type of *Q. conjungens*), Edo. de México, Hidalgo, Puebla, Oaxaca (Mixteca Alta, *Galeotti 103,* the type); also in Nuevo León, Tamaulipas, and central Texas (*Q. laceyi* Small). "Encino roble" (Jalisco).

Usually a small tree, 3–10 m high, the trunk up to 30–40 cm in diameter, with scaly gray bark, the twigs and the glaucous gray-green leaves essentially glabrous at maturity; branchlets 1–2 mm thick, thinly floccose-tomentulose when young, usually soon glabrous (or persistently pilose around the terminal buds), reddish brown, with numerous pale lenticels; buds 2–4 mm long, plumply ovoid, obtuse, brown, the scales ciliate; stipules linear-subulate, 6–9 mm long, pilose, deciduous before the leaves are full grown, or persistent for a time on the terminal bud; leaves when very young reddish, glandular-puberulent and thinly flocculent-tomentose, usually becoming quite glabrous even before full maturity (except for a sparse minute puberulence visible at magnifications of from 25× to 50×), or a few coarse hairs persisting near the base; mature leaves coriaceous, glaucous-green, deciduous, oblanceolate to oblong, elliptic, or obovate, (4–) 6–12 (–15) cm long, 2.5–5 (–8) cm wide, 2–2.5 times as long as wide, obtuse to rounded or retuse at apex, seldom subacute and mucronate; base cordate or abruptly rounded, rarely merely acute; margins slightly cartilaginous-thickened, not or scarcely revolute, occasionally quite entire but commonly undulate or puckered and with 1–7 low coarse sinuate teeth on each side, the teeth usually very low and blunt but each marked by a low callose thickening terminating a vein or veinlet; veins 6–12 on each side, arching-ascending or nearly straight, much branched and anastomosing near the margins, forming connecting veinlets almost the same size as the marginal thickening; upper leaf-surface hard, scarcely lustrous, gray-green, flat, the white or reddish veins and veinlets convex, contrasting with the green spaces between them; lower surface paler, waxy-glaucous, minutely puberulent (as seen at 25×–50×) and obscurely papillose, the pale veins elevated and prominent, the smallest veinlets usually discernible only as fine depressed lines, or not at all; petioles 2–6 mm long, 1–2.5 mm thick at base, pale or reddish and often with a glaucous bloom; staminate aments 2–3 cm long, densely hairy, the anthers pilose, 1–1.6 mm long; pistillate flowers 1–20, scattered and often clustered along a pubescent peduncle up to 5–9 cm long, 1–2 mm thick; fruit annual, solitary or 2–3, often sessile in the leaf axils, sometimes 2–5 cm above the base of the peduncle, the cup hemispheric or deeper, 12–18 mm wide, the scales brownish-tomentulose, somewhat thickened at base, the basal ones rather loose, the upper ones very closely appressed, with brown, densely cottony-ciliate, obtusely triangular tips 1–1.5 mm long; acorns ovoid, 12–18 mm long, one-third to one-half included.

Quercus grisea Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 171. 1854.

Grasslands, hillsides, rocky hills and ridges with shrubs and small trees, sometimes with junipers or with *Mimosa, Acacia,* and *Opuntia,* 2000–2500 m. 20 km west-southwest of Valparaíso (Potrero de las Yeguas, *McVaugh 17774*); El Plateado (*Vela*); between Ojuelos and Aguascalientes (Paso de la Troje, where the common oak on the upper slopes, *McVaugh 12035, 16798*). Western Texas (*Wright 665*!, the type), New Mexico, Arizona, Chihuahua, Durango, Zacatecas, northern Jalisco.

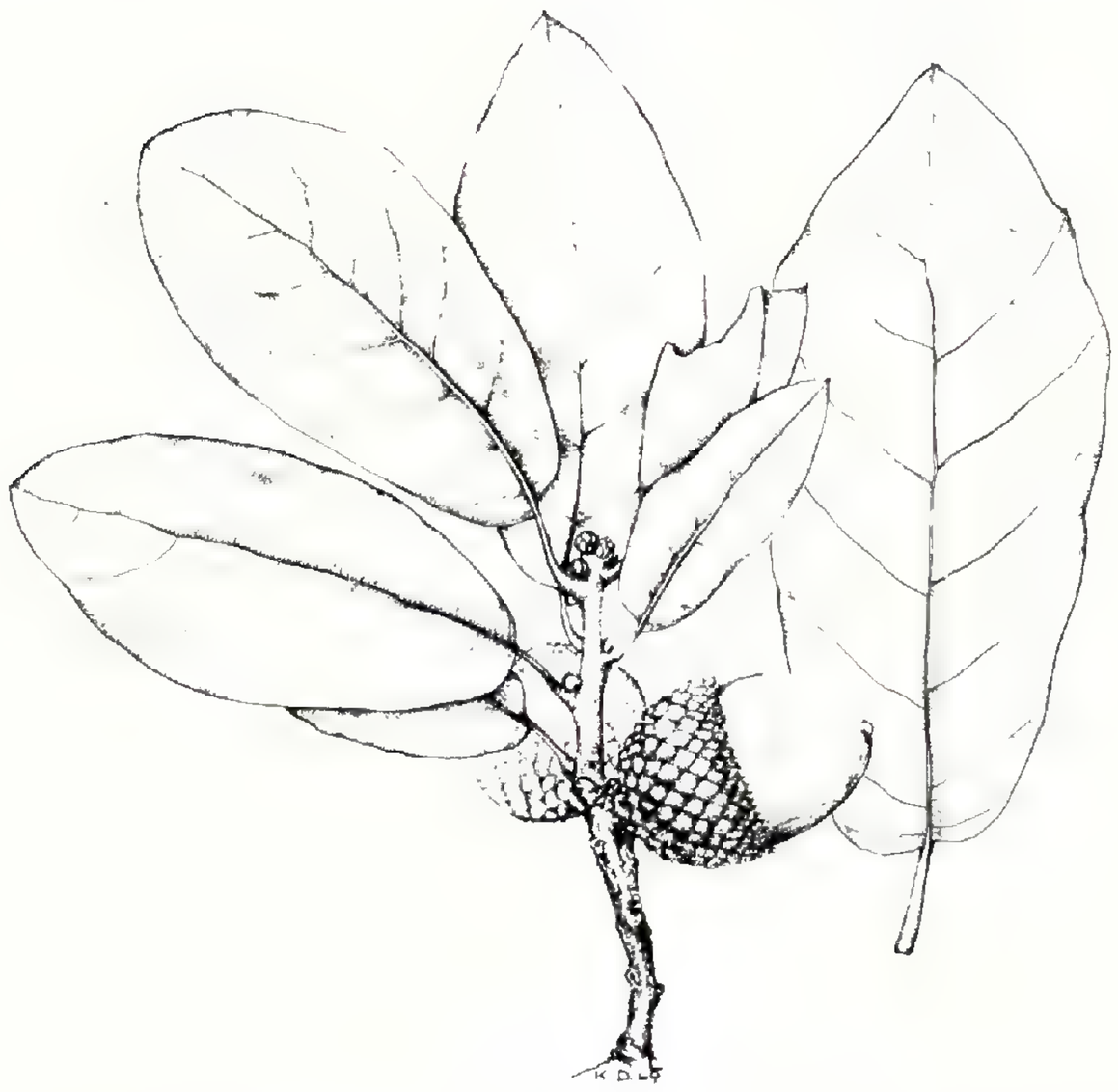

Fig. 20. *Quercus grisea,* × 1. *McVaugh 17643* (southern Zacatecas).

A small round-headed tree 4–7 m high, with short trunk 10–30 cm in diameter, light gray bark and tomentulose gray-green foliage; branchlets 1–2 mm thick, at first densely tomentose, the yellowish-gray tomentum often persisting 2 or 3 years, the bark finally rather rough, dark brown to black, with inconspicuous lenticels; buds round-ovoid, about 2 mm long, brown, the scales ciliate; stipules subulate, 3–6 mm long, pilose, usually rather promptly deciduous, sometimes weakly persistent the first season; leaves deciduous or a few persistent until the second season, thick and leathery, scarcely bicolorous (a little more yellow and paler beneath), (1–) 2–4 (–8) cm long, (0.5–) 0.7–2 (–4) cm wide, oblong-elliptic to ovate, acute and very shortly mucronate or obtuse to rounded at apex, abruptly rounded to subcordate at base, nearly flat, the margins not at all or only slightly revolute, obscurely cartilaginous-thickened, usually entire, seldom (especially on leaves of vigorous shoots) bearing a few low broad mucronulate teeth above the middle; veins 6–10 on each side, ascending, much branched and obviously anastomosing; upper leaf-surface hard, somewhat lustrous but partially covered even in age by somewhat overlapping stellate hairs with rather stiff spreading-ascending branches; large veins pale and slightly convex but not at all impressed, the veinlets inconspicuous; lower surface permanently and closely tomentose, quite obscured by the closely overlapping sessile stellate hairs of different sizes and at different levels, the larger veins elevated and evident, the veinlets not easily discernible; petioles 2–5 (–10) mm long, 1 mm thick or less, tomentose; staminate aments 2–4 (–7) cm long, loosely flowered, pilose, the anthers glabrous, 1–1.2 mm long; pistillate flowers 1–8, scattered along a tomentose peduncle 0.5–4 cm long, 1–1.5 mm thick; fruit annual, solitary or paired, often developing at the very base of the peduncle or 2–3 cm above it; cup 8–15 mm wide, 4–10 mm high, hemispheric, rounded at base, the lower scales somewhat thickened at their pale tomentose bases, the thin and closely appressed tips reddish brown and sparsely pubescent, those of the upper scales elongate, tapering, obtuse, cottony-ciliate; acorns ovoid to ellipsoid, 12–18 mm long, 8–12 mm thick, light brown, over half-included or inclosed at the base only.

Typical *Quercus grisea* occurs mostly north of our range. In Nueva Galicia it may be readily identified by the narrow, gray and usually entire leaves, and by the presence of numerous stellate (about 8-rayed) hairs 0.5 mm wide or more, persistent on the upper leaf-surface even in old leaves. The species is associated in northern Jalisco and southern Zacatecas

with *Q. chihuahuensis, Q. laeta,* and *Q. potosina.* In all of these species occasional plants with subentire, narrow, gray-pubescent leaves suggest the possibility of gene exchange with something like *Q. grisea.* Muller suggests that *Quercus undata* Trel. (Mem. Nat. Acad. Sci. 20: 86. *pl. 135.* 1924) may represent a hybrid between *Q. grisea* and *Q. chihuahuensis.*

Quercus laeta Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 179. 1854. *Quercus pallescens* Trel. Mem. Nat. Acad. Sci. 20: 89. *pl. 141.* 1924. *Quercus bipedalis* Trel. Mem. Nat. Acad. Sci. 20: 89. *pl. 143.* 1924. *Quercus obscura* Trel. Mem. Nat. Acad. Sci. 20: 71. *pl. 88.* 1924. *Quercus transmontana* Trel. Mem. Nat. Acad. Sci. 20: 71. *pl. 89.* 1924.

Hills and ridges in high grassland or open oak woodland, rocky slopes and mountainsides, often with other oaks, seldom with pines, sometimes with *Bursera, Ipomoea* and other small trees, 1500–2300 m, or descending to 600–1200 m in the barrancas of northern Jalisco and Nayarit. Jesús María (*Feddema 1384*); Santa Teresa (*Rose*!, 10 Aug 1897, type of *Q. bipedalis*); Sierra Madre west of Bolaños (*Rose 2960*!, type of *Q. pallescens*); 20 km west-southwest of Valparaíso (*Rzedowski 17539, McVaugh 17775, 17776,* all suggesting introgression with *Q. grisea*); Huejuquilla (*Rzedowski 9108, McVaugh 17697*); 25 km southwest of Villa Nueva (*McVaugh 11988*); Mezquitic (El Mortero, *Rzedowski 17686*); between Jalpa and Tlaltenango (*McVaugh 25679*); Mpio. de Atengo (Cerro de Quelitán, *collector unknown, no. 2209*); 30 km west of Aguascalientes (*McVaugh & Koelz 149*); Sierra del Laurel (*Rzedowski 14135, 14171*); Río Verde north of Tepatitlán (*McVaugh 13275, 17456*); Capilla de Guadalupe, between Arandas and Tepatitlán (perhaps hybridizing here with *Q. obtusata, McVaugh 13269, 13271, 13272*); Talpa de Allende (Sierra de Cuale, *McVaugh 14383*); near Tepic (*Gregg 989*); Cerro Sangangüey (*Breedlove 8062*); 25–30 km west of Ameca (*McVaugh 12153, 12154*); Jocotepec (Sierra de Tecuán, Trojes, *Puga 682*); El Molino, 40 km southwest of Guadalajara (*McVaugh 13318*); above San Juan Cozalá, 2300 m (*Puga 35, 438*); 15 km north of Autlán (*Rzedowski 14583*). Mountains, chiefly of the Central Plateau and bordering ranges, widely distributed and variable. Durango, Sinaloa, southwestern Zacatecas, Aguascalientes, Nayarit, Jalisco, Guanajuato, Michoacán (Pátzcuaro, *Pringle 4116*!, type of *Q. transmontana*), Hidalgo (Grande, *Hartweg 419*!, the lectotype), San Luis Potosí, Nuevo León, Coahuila. The type of *Q. obscura* (*Seemann 1971*!) came from an unknown locality probably in western Durango or adjacent Sinaloa.

Small trees often 5–8 (–12) m high, with short trunk 25–40 cm in diameter, a broad crown, and spreading, crooked branches; sometimes a shrub 50–60 cm high or up to several meters in height; branchlets 1.5–2.5 mm thick, when very young thinly or rather densely pale-tomentose and glandular, soon glabrescent but at least some hairs usually persisting the second season, the bark reddish-brown to black with pale conspicuous lenticels; buds 2–3.5 mm long, ovoid, obtuse, the scales ciliate-margined; stipules 5–6 mm long, membranous, scarious, pilose, deciduous before the leaves are half-grown, or persistent for a time near the tips of the branchlets; young leaves green or reddish above from the first, thinly stellate-pubescent and bearing many lustrous nearly straight simple glandular hairs up to 0.5 mm long; lower surface tomentose, and

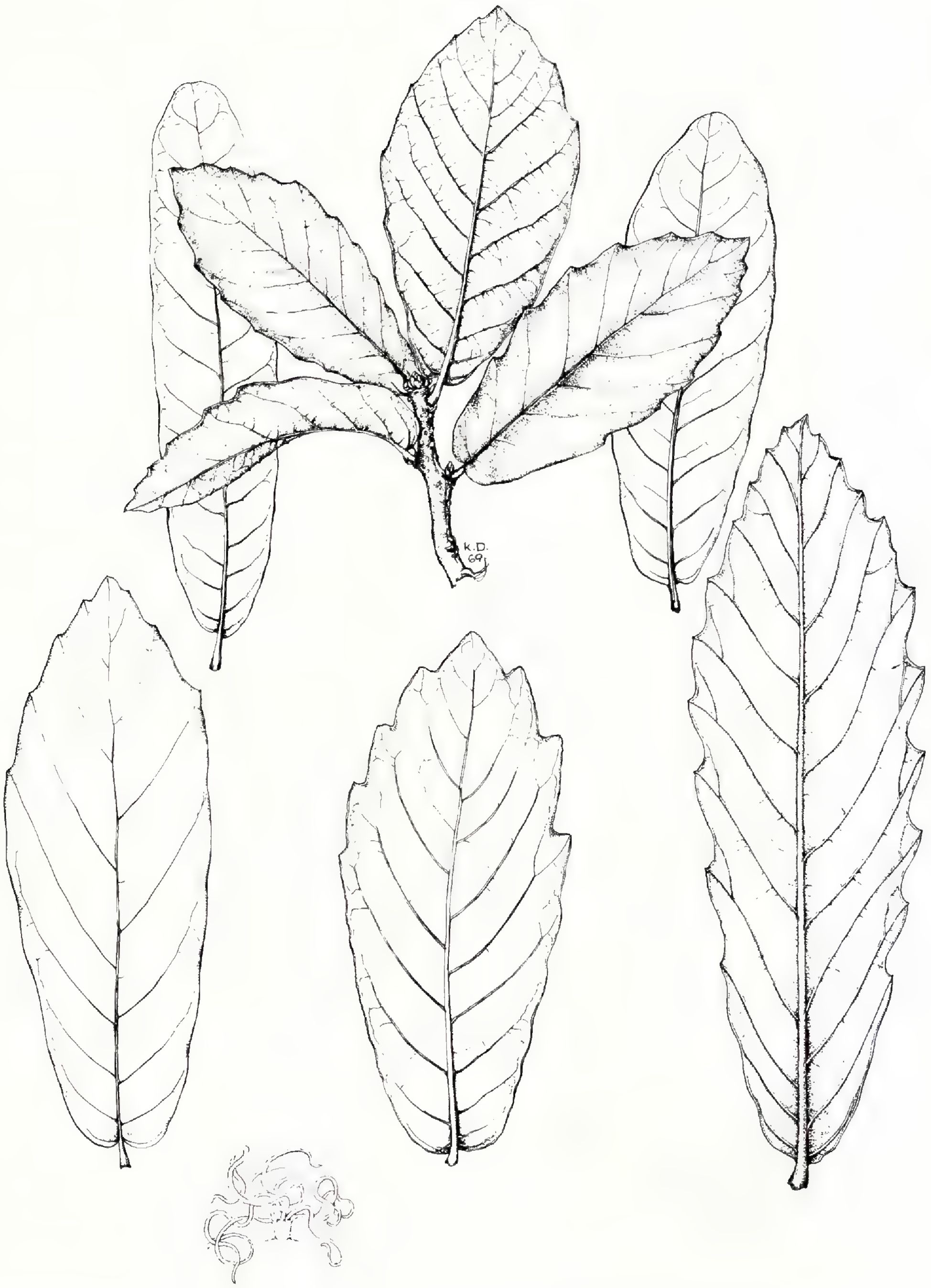

Fig. 21. *Quercus laeta.* Leafy twig, ca × ¾, *McVaugh & Koelz 240* (Jalisco); leaves, ca × ¾, clockwise from upper left, *Wilbur & Wilbur 1703* (Jalisco), *McVaugh 14383* (Jalisco), *McVaugh 11944* (Jalisco), *McVaugh & Koelz 149* (Aguascalientes), *McVaugh 12154* (Jalisco); hair from lower leaf-surface, much enlarged.

with many glandular hairs but these confined to the larger veins; leaves deciduous, when mature stiff and coriaceous, dark green and shiny above, evidently paler beneath, narrowly elliptic to oblong, lanceolate, oblanceolate or obovate, seldom ovate, (3–) 5–9 (–12) cm long, (1–) 2–3 (–6.5) cm wide, (2–) 2.3–3.3 (–4) times as long as wide, obtuse, narrowly rounded, or acute at tip (seldom broadly rounded), abruptly rounded to cordate (seldom acute) at base; margins thickened and revolute, sometimes completely entire, the more vigorous leaves even on the same plant usually bearing at least 1–2 marginal mucros on each side near the tip, more commonly bearing 1–7 blunt, short-mucronate teeth above the middle or near the tip on each side, the teeth up to 5–8 mm high, usually much lower, distant; mucros usually thickened on the lower surface, or curved down as if with the revolute margin; veins 8–11 on each side, ascending, sometimes passing directly into the teeth, otherwise forming strong anastomosing arches near the margins; upper leaf-surface hard, lustrous, pubescent near the base of the blade, and usually retaining scattered small stellate hairs in sheltered spots elsewhere; secondary veins, and often the primaries, usually impressed in old leaves, the blades varying from markedly rugulose to practically flat, the smallest veinlets forming a pale elevated network; lower surface uniformly but rather thinly pubescent, with pale, contorted and tangled, many-branched sessile hairs, a few stiff reddish glandular hairs sometimes persisting on the veins, the glaucous, white-papillose (often conspicuously so) but otherwise glabrous epidermis not or scarcely bullate, the smallest veinlets often discernible as very thin plane or depressed hyaline lines; primary and larger secondary veins conspicuous, elevated almost their full diameter; petioles 2–5 (–8) mm long, pubescent, about 1.5 mm thick at the enlarged base; staminate aments 4–6 cm long, closely flowered, pilose or tomentulose, and glandular, the perianth 2.5–3 mm across, the anthers glabrous or pilose, 1–1.3 mm long; pistillate flowers usually 1–3, near the end of a pubescent peduncle 1–2 (–4) cm long; fruit annual, solitary or paired, the cup hemispheric, 12–15 mm wide, the scales thickened and canescent at base, with narrow, obtuse, appressed tips; acorns ovoid, 12–18 mm long, one-third to one-half included.

It is noteworthy that several populations from much disturbed habitats, where the trees have been cut in pastures or for charcoal, appear to be unusually variable. It may be that some broad-leaved, toothed forms have resulted from hybridization, as e.g. between *Q. laeta* and *Q. obtusata.* In the northern part of our area, plants with narrow leaves sometimes resemble *Q. grisea* in having the pubescence of the upper leaf-surface long-persistent, and the tomentum as a whole more dense than usual in *Q. laeta.*

A population from the coastal slopes of the mountains between Autlán and La Resolana, where at 650–950 m elevation the trees form an important element in the oak forest, may represent yet another taxon (*McVaugh 11942, Wilbur 1903, Rzedowski 14715, 14719, 14720*). The leaves are consistently narrow and usually entire, and the anthers are glabrous.

There appear to be no real differences between *Quercus laeta,* which Trelease knew from Hidalgo only, and *Q. bipedalis, Q. pallescens, Q. obscura,* and *Q. transmontana,* which he described from Nayarit, northern Jalisco, Durango or Sinaloa, and Michoacán, respectively. *Quercus prinopsis* Trel. (Mem. Nat. Acad. Sci. 20: 61. *pl. 58, lower figure.* 1924), based on *Purpus 4941* from San Luis Potosí, is probably also a synonym of *Q. laeta.*

In the type of *Q. laeta,* and the types of the synonymous names listed above, the leaves are commonly elongate, and coarsely if sometimes shallowly toothed, at least toward the apex; the blades are commonly

rugulose and dark green above, pale and rather prominently papillose, and rather thinly pubescent, beneath. In some extreme forms the leaves become entire and obtuse, or almost completely glabrous beneath, or flat rather than rugulose. Such aberrant forms are relatively rare; they are known from all parts of the range of *Q. laeta,* and their significance is not understood.

It has been suggested (Contr. Univ. Michigan Herb. 9: 516. 1972) that the name *Quercus diversifolia* Née (An. Ci. Nat. 3: 270. 1801) may also apply to the plant here called *Q. laeta.* The identity of *Q. diversifolia* is somewhat in doubt, and it seems unwise to take up the name until the question has been resolved.

Quercus laurina Humb. & Bonpl. Pl. Aequinoct. 2: [28]32. *pl. 80.* 1809. *Quercus lanceolata* Humb. & Bonpl. Pl. Aequinoct. 2: [29]34. *pl. 81.* 1809. *Quercus barbinervis* Benth. Pl. Hartw. 56. 1840. *Quercus ocoteaefolia* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 176. 1854. *Quercus tlapuxahuensis* [sic] A. DC. in DC. Prodr. 16, pt. 2: 29. 1864.

Mountainsides, ridges, barrancas, usually in humid forest with pines or firs, or other species of oaks, 2000–3000 m, often abundant above 2500 m, ascending higher than any other species of oak in our flora, fruiting September to December, the staminate flowers produced with the new leaves in March and April. Cerro Tequila (*McVaugh 23913*); Santa Mónica (*McVaugh 14103*); Autlán (*Wilbur 1898*); Nevado de Colima (*McVaugh 11666*); Coalcomán (8–12 km southwest of Dos Aguas, *McVaugh 22816*); Cerro Patamban (*Rzedowski & McVaugh 664*); Tancítaro (*Hinton 15681*). Jalisco, Michoacán (Tlalpuxahua, *Hartweg 430,* type of *Q. tlapuxahuensis*), Guanajuato (west of Cerro Zamorano, *McVaugh 10394*), Hidalgo (*Bonpland 4142,* the type; "Moran to Santa Rosa," *Bonpland,* type of *Q. lanceolata:* Real del Monte, *Hartweg 427,* type of *Q. barbinervis*), Puebla, Edo. de México, Oaxaca (Talea, *Liebmann,* type of *Q. ocoteaefolia*).

A large forest tree, up to 30 m high or more, often 15–20 m, with trunk 1 m in diameter or more;* branchlets 1–2 mm thick, densely and finely pale-tomentulose when young, the tomentum usually persisting at least in sheltered spots for one or more seasons, the bark dark reddish brown to black, with many pale lenticels; buds 2–4 mm long, ovoid, acute, brown, the scales ciliate; stipules 5–8 mm long, scarious, membranous, oblanceolate to subulate, deciduous before the leaves are half-grown; very young leaves densely covered (and colored) by short, vermiform, simple, reddish or amber-colored hairs, and sparsely pubescent with stellate hairs, most of the hairs disappearing from both surfaces before the leaves are full grown; mature leaves rigidly coriaceous, green and lustrous, tardily deciduous, often blackened beneath by epiphytic fungi or lichens, elliptic-oblanceolate to lanceolate, (4–) 6–9 (–13) cm long, (1–) 1.5–3.5 (–5) cm wide, (2–) 2.5–3 (–4) times as long as wide, acute to attenuate and usually aristate at apex, sometimes acuminate, the base rather abruptly rounded, occasionally subcordate, or a little prolonged and subacute; margins strongly thickened but not or scarcely revolute, often noticeably undulate and puckered, entire, or often on the same plant bearing 1–4 aristae or low aristate teeth or coarse antrorse

*The largest tree measured was 5 m in circumference, breast high.

Fig. 22. *Quercus laurina*, × 1. Leafy twig, *McVaugh 11627*; leaves, left to right, *McVaugh 12918, 13464, 13838*. All from Jalisco.

serrations on each side of the blade above the middle; large veins 5–9 on each side, commonly arcuate-ascending, diverging from the midvein at varous angles, one or two of the lowest on each side usually much weaker than those above, and soon curving and anastomosing, all similarly branching and anastomosing well within the margin; secondary veins connecting the lower laterals mostly crooked and irregular; upper leaf-surface green, glossy, flat (the large veins not or scarcely depressed), the pale elevated veins and veinlets contrasting with the green spaces between them; lower surface lustrous, drying slightly yellow, nearly glabrous but invariably with some glandular hairs persisting, and with tufts of coarse pale stipitate hairs in the axils of the larger veins; veins and veinlets elevated, but less contrasting than on the upper surface, the epidermis green, papillose; petioles (3–) 6–12 (–20) mm long, 1–1.5 mm wide at the base of the blade, 1.5–2 mm wide at the thickened base, often persistently tomentose; staminate aments 8–11 cm long, thinly pilose, the perianth broadly campanulate, 2.5 mm high with broad, obtuse, ciliate-fringed lobes, the anthers ellipsoid, glabrous, 2.3 mm long; pistillate flowers 1–3, lateral and terminal on a stout peduncle up to 1–2.2 cm long; fruit biennial, solitary or paired, the peduncle becoming 2–4 mm thick, the cup hemispheric or a little prolonged at base, 12–15 mm wide, the margins not inrolled; scales woody, canescent to nearly glabrous, the lower ones thickened at base, the tips closely appressed, pale brown, obtusely triangular; acorns short-ovoid, 15–17 mm long, 10–12 mm thick, about one-third included.

Sterile specimens with large entire leaves may be mistaken for *Quercus conspersa,* which occurs in a few localities in Nueva Galicia but generally in drier situations at considerably lower elevations.

Quercus magnoliifolia ["*magnoliaefolia*"] Née, An. Ci. Nat. 3: 268. 1801. *Quercus macrophylla* Née, An. Ci. Nat. 3: 274. 1801. *Quercus circinata* Née, An. Ci. Nat. 3: 272. 1801. *Quercus lutea* Née, An. Ci. Nat. 3: 269. 1801. *Quercus nudinervis* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 182. 1854. *Quercus magnoliaefolia* γ? *macrophylla* (Née) A. DC. in DC. Prodr. 16, pt. 2: 27. 1864. *Quercus haematophlebia* Trel. Mem. Nat. Acad. Sci. 20: 66. *pl. 74.* 1924. *Quercus tepicana* Trel. Mem. Nat. Acad. Sci. 20: 135. *pl. 255.* 1924. *Quercus platyphylla* Warb. Kew Bull. 1939: 85. 1939.

Hillsides and ravines, precipitous rocky slopes, mountainsides, hilly savannas, often in almost pure stands forming open woodlands, sometimes with pines or other oaks, 800–1800 m (sometimes as high as 2200 m, or in small isolated areas as low as 375 m), the fruit ripening August to November, the staminate flowers produced in April. Dolores (*Rose 3363*!, type of *Q. haematophlebia*); Jesús María (*Feddema 1417*); Las Ranas, Sa. de los Huicholes (*Philbrick & Lewis*); Compostela (*McVaugh 15305*); Mazatán (*Rzedowski 17916*); San Leonel (*Gregg 976*); Ahuacatlán (*Feddema 362*); Tequila (*M. Martínez 172*); Cabo Corrientes (southeast of El Tuito, *McVaugh 25429*); Talpa de Allende (above La Cuesta, *McVaugh 20253*; 7 km north-northeast of Talpa, *McVaugh 20340*); 25 km west of Ameca (La Estanzuela, *McVaugh 12174*); 25 km south-southeast of Autlán (*Wilbur 2065*); south of La Huerta (*McVaugh 19846*); 15–20 km north of Barra de Navidad (*McVaugh 11890*); Montes de San Antonio, Colima (*Nápoles,* ENCB 780); Tecalitlán (toward San Isidro, "2200 m," *Roe & Roe 2104*); Mazamitla (*McVaugh 13099*); Mpio. de Jocotepec (Trojes, *Puga 480*); north of Guadalajara (*Puga 400*); Chiquilistlán (*Jones 442, 444*); Tecolotlán (*McVaugh 11965*); Hda. Coahuayula (*Emrick 19, 63*).

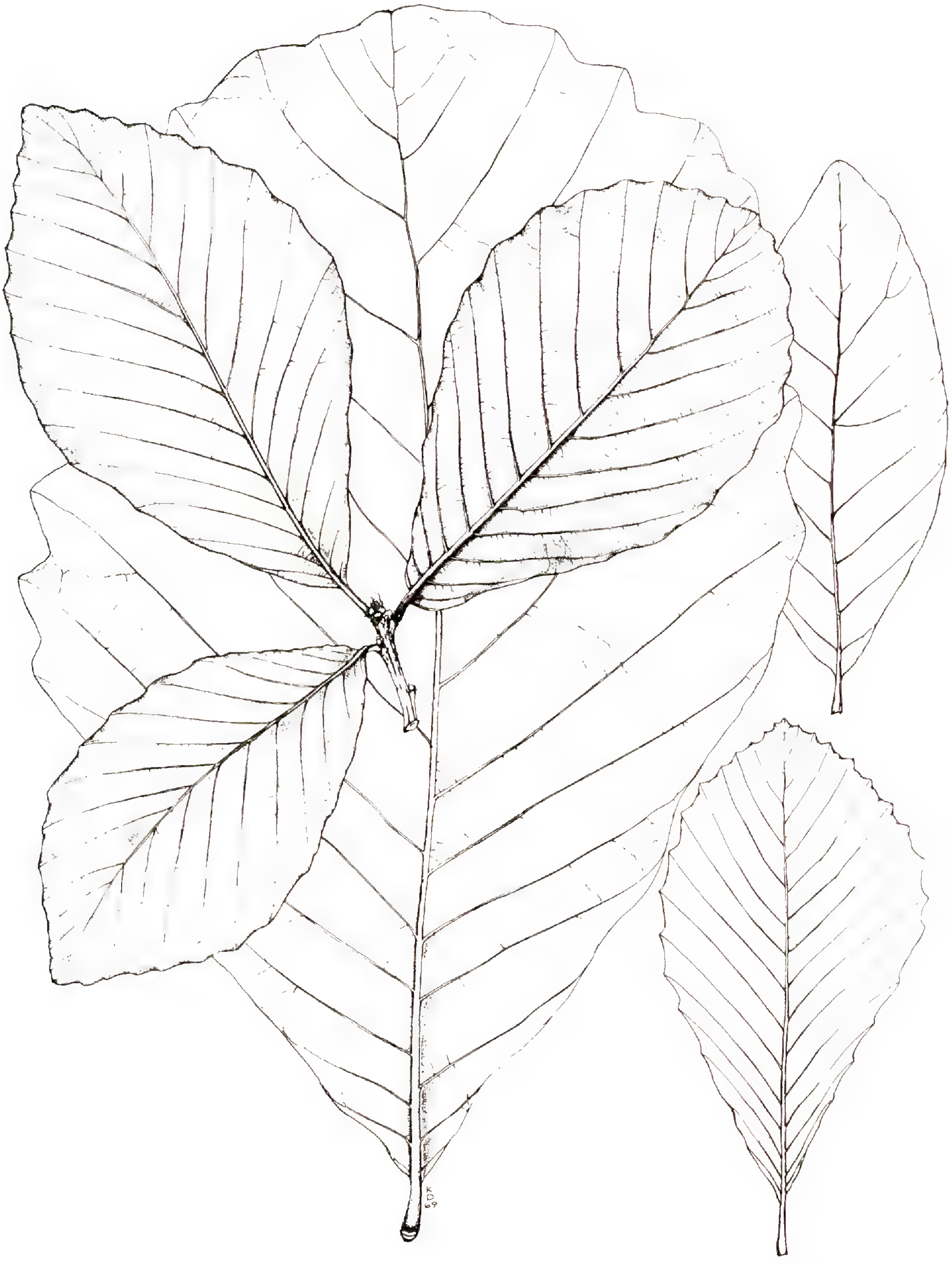

Fig. 23. *Quercus magnoliifolia*, × ½. Leafy twig, *Wilbur & Wilbur 2065* (Jalisco); large leaf, *McVaugh 15305* (Nayarit); upper right, *McVaugh 15183* (Nayarit), lower right, *McVaugh 20340* (Jalisco).

Sinaloa (Cerro de Pinal, *Seemann 1457*!, type of *Q. nudinervis*), Nayarit, Jalisco, Colima, Michoacán, Guerrero (between Chilpancingo and Tixtla, *Née,* the type, and types of *Q. macrophylla, Q. circinata* and *Q. lutea*), Edo. de México (*Hinton 6360*!, type of *Q. platyphylla*), Oaxaca; Central America.

Often a round-headed tree with spreading branches, 5–10 m high, but in deep forest soils 12–15 m high, with trunk 35–60 cm or even 1 m in diameter; branchlets 2–4 mm thick, longitudinally striate or grooved, not deeply and coarsely fluted, at first glandular-granular and finely stellate-pubescent, soon glabrescent, often becoming quite glabrous before the end of the first season, reddish brown, usually with many large and conspicuous lenticels; old leaf-scars 3–5 mm wide, seldom wider; buds 2.5–4 mm long, seeming disproportionately small for the size of the twigs and leaves, light brown, ellipsoid-ovoid, often obtuse, nearly glabrous, the terminal ones usually clustered among the persistent subulate-filiform stipules 5–8 mm long, the other stipules deciduous; young leaves green above almost from the first, usually copiously beset with short vermiform, glandular, simple, reddish or amber-colored hairs and sparsely or moderately stellate-pubescent, the lower surface tomentose, glandular chiefly on the veins; mature leaves very large and stiff, pale-tomentose beneath, very broadly to rather narrowly obovate, seldom elliptic, (10–) 15–25 cm long (or the larger ones on any given tree often 30–45 cm long), (5–) 7–12 (–25) cm wide, 1.5–2.3 times as long as wide, rather abruptly narrowed to a broadly rounded, obtuse, or even subacute tip, more gradually narrowed and tapering below the middle to the base, the very base of the blade cuneate or acute to rounded or even auriculate; margins thickened and definitely revolute, sinuate or coarsely sinuate-dentate, the teeth (5–) 10–18 on each side, mostly low, rounded and asymmetric, callose-tipped or shortly mucronate but the mucros usually turned down with the revolute margin and not discernible from above; veins mostly 10–20 on each side, ascending, usually straight and parallel without conspicuous intermediates, mostly passing directly and strongly into the teeth when these are present, the others anastomosing near the margin; upper surface hard, lustrous, nearly glabrous, often pubescent at the base of the midvein and with small scattered stellate hairs elsewhere; large veins strongly marked, scarcely or noticeably impressed, the secondary veins usually impressed and the blade evidently rugulose, the smallest veinlets pale and slightly elevated; lower surface pale-tomentose, the hairs sessile, overlapping, usually obscuring the green, papillose, bullate and glandular-puberulent epidermis, but occasionally sparse and scattered; primary and secondary veins forming a strong, raised reticulum, the tiny veinlets visible only as depressed lines between the bullae; petioles (3–) 5–12 mm long, soon glabrous, or persistently pubescent at least on the inner face, noticeably enlarged toward base and there 2–5 mm thick; staminate aments 3–4.5 cm long, closely flowered, pilose and glandular, the perianth pilose without, subrotate, 3 mm long; pistillate flowers solitary or several, scattered on a glabrescent peduncle up to 5–10 cm long; fruit annual, the cup hemispheric, 15–23 mm wide, the gray-tomentose scales much thickened at base, their narrowly triangular obtuse tips erect, pubescent; acorns ovoid, 18–28 mm long, 12–22 mm thick, thin-walled, wrinkled in drying except when fully mature, about one-third or less included.

The type-material of *Quercus tepicana*, collected by Rose near Pedro Paulo, Nayarit, was a mixture. The leafy twig is a specimen of *Q. magnoliifolia*, whereas the detached acorns and cups (some of which are illustrated by Trelease) are those of a black oak, perhaps *Q. aristata*.

Quercus martinezii C. H. Muller, An. Inst. Biol. [Méx.] 24: 274. "1953" [24 Mar 1954].

Steep mountainsides, barrancas, streamsides, in deep soils, sometimes over limestone, in pine-fir forest or other humid forest with firs and broad-leaved trees, 2200–2500 m. San Sebastián (Real Alto, *Mexia 1751*); Sierra de Manantlán, 25–30 km southeast of Autlan (*McVaugh 13912*!, the type; *McVaugh 13861*); Coalcomán, 25 km southwest of Dos Aguas (*McVaugh 22855*). Mountains of the Pacific slope and the Sierra Volcánica Transversal, Jalisco and Michoacán.

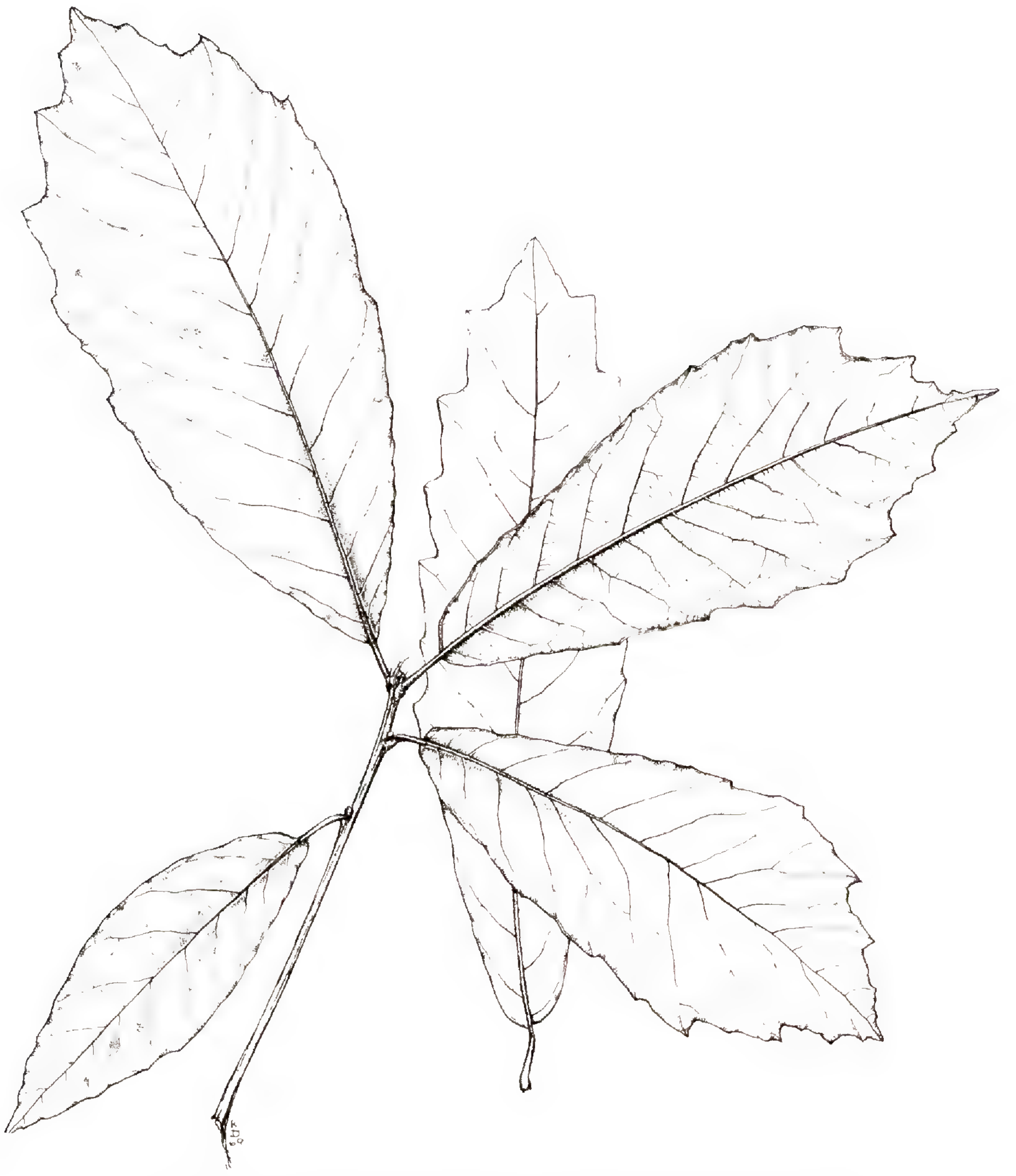

Fig. 24. *Quercus martinezii*, × ½. *McVaugh 13912* (Jalisco).

A tall forest tree up to 20–25 m high with straight trunk up to 50 cm or more in diameter, and gray, flaking bark; branchlets 2–5 mm thick, densely gray-tomentose, the tomentum usually persisting into the second season or longer, the lenticels numerous, evident, but sometimes hardly paler than the tomentum; buds 2.5–3 mm long, ovoid, obtuse, the outer scales tomentose, the inner ones long-ciliate; stipules subulate, pilose, 5 mm long, persistent about the terminal bud only; leaves probably evergreen, thick and stiffly coriaceous, gray-green above, whitened beneath, oblanceolate to obovate or elliptic, (7–) 12–20 cm long, (2.5–) 4–7 (–9) cm wide, 2.5–3.5 times as long as wide, acute or acuminate but the very tip blunt, gradually or abruptly rounded and often unequal-sided at base; margins cartilaginous, usually slightly revolute, seldom merely undulate or quite entire, usually entire near the base of the leaf and coarsely toothed above the middle, the teeth often 3–6 on each side, up to 5–8 mm high, acute or often with straight sides forming an obtuse angle, bearing a terminal callus or short mucro; veins 8–12 on each side, sometimes with additional intermediate ones, ascending, passing directly into the teeth if any, often curved forward, anastomosing near the margins and arching toward the next succeeding ones; upper surface hard, lustrous, very finely reticulate but only the large veins evident to

the unaided eye, the persistently tomentulose midvein and the main lateral veins a little depressed below the essentially glabrous surface; lower surface persistently glaucous-gray, minutely wrinkled and obscurely papillose, copiously pubescent and sometimes entirely hidden by limply spreading or crumpled sessile hairs with 10–12 or more branches; veins pale, the midvein and main lateral veins much elevated; petioles (5–) 10–15 (–30) mm long, 1.5–2.5 mm thick (or up to 3.5 mm at base), persistently tomentose; staminate catkins not seen mature; anthers glabrous, 1.3 mm long or more; fruit annual, several together on a peduncle up to 6 cm long; cup about 20 mm in diameter, 12–15 mm high, deeply cup-shaped, the outer scales with much thickened tomentose bases, the tips of the scales narrow, dark, smooth and flat, ciliate; acorn narrowly ovoid, rounded at apex, dark, 18–20 mm long, 15–18 mm thick, one-third to one-half included.

This distinctive species of western Mexico was named for Professor Maximino Martínez (1888–1964) of the Instituto de Biología, whose many contributions to Mexican botany included a number of studies on the taxonomy of the genus *Quercus*. By an odd coincidence, it was discovered in Michoacán by Martínez about two weeks after it was first found in Jalisco by others.

Quercus microphylla Née, An. Ci. Nat. 3: 264. 1801. *Quercus striatula* Trel. Mem. Nat. Acad. Sci. 20: 93. *pl. 151.* 1924.

Rocky hills, grasslands with scattered pines, or with other oaks and small trees in open woodlands, 1800–2000 m or more, scarcely known from Nueva Galicia. Sierra Madre near Santa Teresa (*Rose 2177*); Sierra de los Morones, near Plateado (*Rose 2733*). Western Durango (*Endlich*, type of *Q. striatula*), Jalisco, Guanajuato (*Née*, the type), Hidalgo, San Luis Potosí.

A rhizomatous shrub 30–60 cm high or less, or (according to Née) up to 1–1.5 m high, often forming dense mats several meters across; branchlets 1–1.5 mm thick, gray-tomentose, usually glabrescent the second or third year, the bark reddish-brown to black, with inconspicuous lenticels; buds 1–2 mm long, plumply ovate, obtuse, brown, the scales ciliate; stipules filiform or subulate, 3–5 mm long, pilose, persistent for a time on the terminal buds, or all persistent for a part of the first season; leaves

Fig. 25. *Quercus microphylla*, × 1. Left to right, *Muller 9030, 9015* (both from Durango).

small, gray-green, or a little yellowish beneath, elliptic-lanceolate or elliptic-ovate, 1–2.5 (–3.5) cm long, (0.3–) 0.7–1.2 (–2) cm wide, (1.5–) 2–3 (–3.5) times as long as wide, rather abruptly acute or subacute and mucronate at apex, varying especially on vigorous shoots to obtuse or rounded, and lacking the mucro; base rounded to cordate; margins thickened and slightly revolute, usually entire, often undulate, sometimes with 1–2 coarse and often mucronate teeth above the middle; veins 4–8 on each side, ascending, branching and anastomosing well within the margins, inconspicuous and flat or slightly impressed above, the larger ones elevated beneath and forming a slightly darkened pinnate pattern on the surface, the smaller veins and veinlets usually obscured by the tomentum; upper leaf-surface hard, somewhat lustrous, persistently and copiously stellate-pubescent with soft or crumpled hairs, the fine reticulate veinlets not very conspicuous except in old denuded leaves; lower surface densely and closely tomentose, the hairs gray or yellowish gray, closely sessile, overlapping in several sizes and layers, quite covering the obscurely glandular and papillose epidermis; petioles tomentose, 1.5–3 mm long, up to 1 mm thick, often much depressed between the sides of the leaf-base; staminate aments unknown; pistillate flowers 1–3, on a tomentose peduncle up to 1 cm long, 1 mm thick; fruit solitary or paired, the cups hemispheric, 10–13 mm across, the scales gray-tomentose, a little thickened at base, appressed, with brownish, triangular, obtuse, cottony-ciliate tips; acorns ovoid, 10–12 mm long, about half-included.

Née states that he saw this plant in September, 1791, and again in November of the same year, "en los altos cerros de Acambaro," and along the road between Guanajuato and San Miguel el Grande.

Quercus obtusata Humb. & Bonpl. Pl. Aequinoct. 2: [23]26. *pl. 76.* 1809. *Quercus pandurata* Humb. & Bonpl. Pl. Aequinoct. 2: [24]28. *pl. 77.* 1809. *Quercus hartwegi* [sic] Benth. Pl. Hartw. 56. 1840. *Quercus obtusata β pandurata* (Humb. & Bonpl.) A. DC. in DC. Prodr. 16, pt. 2: 27. 1864. *Quercus obtusata γ hartwegi* (Benth.) A. DC. in DC. Prodr. 16, pt. 2: 27. 1864. ?*Quercus convallata* Trel. Mem. Nat. Acad. Sci. 20: 88. *pl. 140.* 1924. *Quercus crenatifolia* Trel. Mem. Nat. Acad. Sci. 20: 57. *pl. 52.* 1924. *Quercus panduriformis* Trel. Mem. Nat. Acad. Sci. 20: 62. *pl. 62, lower figure.* 1924. *Quercus rugosa* sensu Trel. Mem. Nat. Acad. Sci. 20: 75. 1924, not *Q. rugosa* Née. *Quercus atriglans* Warb. Kew Bull. 1939: 88. 1939.

Mountainsides and ravines, stream-valleys, usually in relatively moist forest with pines or firs, sometimes with other oaks, or with *Fraxinus, Alnus* and *Salix*, and often one of the dominant trees in such forest, 1500–2500 m or above this; more local, and perhaps hybridized with other white oaks, in drier, more open oak-pine forest on rocky or gravelly hills, in pastures and other disturbed habitats; acorns ripening in October and November, the staminate flowers produced in April with the new leaves. Between Jalpa and Tlaltenango (*McVaugh 25648*); San Martín de Bolaños (10 km northwest of El Platanar, 2450 m, *Rzedowski 26171*); Cerro San Juan above Jalisco, Nayarit (*McVaugh 15232*); Cerro Sangangüey (*Breedlove 8055*); Talpa de Allende (Sierra de Cuale, *McVaugh 14321*; 20 km southeast of Talpa, *McVaugh 21476*); Santa Mónica (*McVaugh 14133*); San Miguel de la Sierra (*McVaugh 14174*); 10–12 km west of Los Volcanes (Sierra de la Campana, *McVaugh 20022*); Autlán (Sierra de Manantlán, *Wilbur 1900*); "Colima" (?*Kerber 206, 208,* cited by Trelease as *Q. laxa*); Tecalitlán (*M. Martínez 195*); Nevado de Colima

Fig. 26. *Quercus obtusata.* Leafy twig, × ½, *McVaugh 20022* (Jalisco); twig with cups, × 1, *McVaugh 20022*; leaves, × ½, clockwise from upper left, *McVaugh 11792, 14133, Wilbur & Wilbur 1973, McVaugh 13572* (all from Jalisco); portion of leaf-margin with recurved mucro, much enlarged.

(*McVaugh 11792*); Tapalpa (*McVaugh 20554, 20569*); Mazamitla (*McVaugh 13201*); Chiquilistlán (*Jones 440*!, type of *Q. crenatifolia*); Tecolotlán (*M. Martínez 403*); mountains near (north of) Lake Chapala, 7000 ft (*Pringle 7072*) "Guadalajara" (*Galeotti 119*); southeast of Tepatitlán (Cerro Gordo, *McVaugh 17483*); Pénjamo (Cerro El Fuerte, *Arroyo F. 2084*); Tancítaro (*J. G. Martínez 2044*); Coalcomán (Sierra Torrecillas, *Hinton 12434, 12756*). Southern Zacatecas, Nayarit, Jalisco, Michoacán (Tuxpan, *Hartweg 432,* type of *Q. hartwegii*; Ario de Rosales, *Bonpland 4329*, type; *Bonpland 4330,* type of *Q. pandurata*; *Endlich 1357,* type of *Q. panduriformis*), Edo. de México (Temascaltepec, *Hinton 6549*!, type of *Q. atriglans*), Morelos, San Luis Potosí, Guanajuato, Hidalgo, Puebla. "Encino roble" (Michoacán); "encino blanco" (Michoacán).

Often a large forest tree, up to 15–20 m high, the trunk 50–60 cm or up to 1 m in diameter, with scaly gray bark; branchlets 1.5–3 mm thick, at first thinly tomentulose and glandular-puberulent, glabrescent but some of the hairs often persistent more than one season, the bark reddish brown with many pale lenticels; buds 3–5 mm long, ovoid, subacute, light brown, pubescent at base; stipules 6–12 mm long, scarious, densely pilose, subulate, persistent about the terminal bud and sometimes for a period at a few adjacent nodes; young leaves somewhat bicolored, green above but sparingly stellate-pubescent and bearing numerous short reddish glandular hairs, the lower surface strongly yellowed by the dense covering of short, simple, vermiform, amber-colored glandular hairs, interspersed wtih some pale soft stellate hairs; straight simple eglandular hairs on the large veins up to 0.6–0.8 mm long; leaves probably deciduous, at maturity thick and coriaceous, usually flat (i.e. not concave), rugulose, obovate to long-obovate, elliptic, or subpandurate (i.e. narrowed and then prolonged or even widened again near the base), (5–) 7–15 (–21) cm long, (2–) 3–8 (–11) cm wide, 1.7–2.4 (–2.8) times as long as wide, rather abruptly narrowed from above the middle to an obtuse or rather broadly rounded (seldom subacute) tip, gradually tapered or sometimes rather broadly incurved to the abruptly rounded or subcordate, or occasionally subacute, base; margins thickened and usually distinctly revolute, coarsely and obtusely sinuate-dentate to subentire, usually with 5–8 low teeth or broad undulations extending from the middle or below to the tip of the blade; tips of the teeth usually terminated by a blunt mucro-like thickening that is broader than high, turned down as if revolute with the margin, and not or scarcely discernible from above; veins about 8–12 on each side, ascending, irregularly much-branched within the margin, with many connecting and anastomosing secondary veins, some of the primary veins passing directly into the teeth, but even these usually branched and much diminished distally; upper leaf-surface hard, lustrous, tomentose near the base of the midvein and usually with small scattered stellate hairs elsewhere, drying yellowish green, rugulose, the primary veins nearly flat, the secondaries evidently impressed, the finest veinlets forming a pale elevated network on a green background; lower surface slightly paler, persistently and copiously glandular, sparsely pubescent with soft, crumpled, 8–12-branched hairs 0.5 mm long or a little more; epidermis waxy-glaucous, papillose, shallowly bullate; largest veins elevated almost their whole thickness above the surface, forming with the convex smaller veins a pale strong network, the smallest veinlets not discernible among the bullae; petioles 7–12 (–20) mm long, 1–2 mm thick at base, pubescent, in the plane of the blade or a little depressed between the sides of the base; staminate aments 3–6 cm long, rather densely flowered or interrupted, pilose and glandular, the perianth long-pilose, the anthers glabrous or coarsely pilose, 1.3–1.7 mm long; pistillate flowers 1–6 or more, scattered or clustered on the distal half of the slender pubescent peduncle 1–5 cm long; fruit annual, 1–3 usually developing near the tip of the peduncle 1.5–2.5 mm thick and up to 6 cm long; cup 15–25 mm wide, thin-margined, hemispheric or shallower, the scales gray-tomentose and much thickened at base, brown or grayish, triangular, the obtuse tips appressed, or pushed out and slightly flared by the thickened bases of adjoining scales; acorn short-ovoid, (12–) 17–20 mm long, (10–) 15–18 mm thick, about one-third included.

In the northern part of our area there is a plant closely related to *Q. obtusata* and perhaps properly treated as a geographically isolated population or series of populations of that species. It is essentially indistinguishable from *Q. obtusata* except by the somewhat broader leaves and shorter peduncles, and the tomentose branchlets:

Quercus convallata Trel. Mem. Nat. Acad. Sci. 20: 88. *pl. 140.* 1924. *Quercus rhodophlebia* f. *apus* Trel. Mem. Nat. Acad. Sci. 20: 74. *pl. 96, lower figure.* 1924. *Quercus rhodophlebia* f. *inclusa* Trel. Mem. Nat. Acad. Sci. 20: 74. *pl. 97, upper figure.* 1924.

Rocky hills, relatively dry open oak- or oak-pine forest, 2000–2500 m. Sierra de Nayarit (Territoire Huichol, *Diguet*!, the type); north of Monte Escobedo, 2400 m, road to Mezquitic (*McVaugh 12014*); Sierra Madre west of Bolaños (*Rose 3726*!, type of f. *inclusa*); Sierra de los Morones, near Plateado (*Rose 2721*!, type of f. *apus*); Tepatitlán (Cerro Gordo, *McVaugh 17505*). Northern Jalisco and adjoining parts of Zacatecas, northwestward into Durango.

Branchlets rather densely and persistently tomentose; leaves usually drying brown, relatively broad and short, obovate, seldom more than twice as long as wide, or more than 12 cm long; peduncles seldom more than 3 cm long, the fruit often sessile.

These plants have usually been identified with *Quercus laxa* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 181. 1854, but that is a different species, with long peduncles and stiff persistent hairs on both leaf-surfaces; it is perhaps related to *Q. praeco* or *Q. chihuahuensis*, and it appears to be unknown except through the type (*Seemann 1967*!), which probably came from western Durango or adjacent Sinaloa. The other specimens cited by Trelease under *Q. laxa* included *Gregg 989*! from near Tepic (actually a specimen of *Q. laeta*), *Galeotti 119* from eastern Jalisco (identified in Brussels by Muller as *Q. obtusata*), and 3 specimens from Berlin that have since presumably been destroyed (*Kerber 206, 208*, from "Colima," and *Endlich 1385*, from Michoacán).

Quercus oocarpa Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 184. 1854.

Forests in barrancas, humid stream-valleys, with other species of oaks, *Carpinus, Magnolia, Matudaea* and *Podocarpus*, 1200–1700 m. Very local in Nueva Galicia. Talpa de Allende, on the headwaters of the Río de Talpa (*McVaugh 20383, 20449*); coastal slopes of the Sierra de Manantlán, 25–35 km southeast of Autlán (*McVaugh 14006*). Jalisco; Guatemala (*Warscewicz 50a*, the type; Costa Rica and western Panama.

A tall forest tree up to more than 25 m high, with straight trunk to more than 1 m in diameter; branchlets rather coarse, 2.5–5 mm thick, densely fulvous-tomentose, eventually glabrescent, gray or light brown with inconspicuous lenticels; buds plump, 4–7 mm long, glabrous, the stipules linear, pilose, 10–13 mm long, somewhat persistent; leaves evergreen or tardily deciduous, thin and papery to subcoriaceous when dry, oblanceolate (usually) to obovate or elliptic, (10–) 15–30 (–45) cm long, (3–) 8–12 (–15) cm wide, acuminate (often narrowly so) at apex, narrowed from the middle or above to a cordate-auriculate (or seldom rounded or even attenuate) base, occasionally rather broadly rounded and cordate; margins cartilaginous-thickened and slightly revolute, entire near the base only, undulate- or serrate-dentate, the teeth (3–) 7–20 on each side, often curved-ascending, up to 3–5 mm high, tipped by a stout mucro 0.3–0.8 mm long; veins 12–22 on each side, spreading-ascending, straight and ladder-like near base, curving forward and anastomosing distally, passing into the teeth where these are present; upper surface hard, dark green and somewhat lustrous, finely reticulate, finally glabrous except the persistently tomentose and slightly depressed midvein and primary lateral veins; lower surface a paler, yellower green, slightly lustrous and obscurely papillose, the areoles essentially glabrous, the pale raised network of veins and veinlets bearing numerous scattered sessile, erect, 2–7-branched hairs 0.3–1 mm long; mature leaves often appearing subsessile because of the large blades, the petioles hirsute-tomentose, sometimes only 3–5 mm long and 3–4 mm

Fig. 27. *Quercus oocarpa*, × ½. *McVaugh 20383* (Jalisco).

thick, in other leaves up to 1 cm long; flowers unknown; fruit annual, very large, solitary or paired on a peduncle up to 2 cm long, 5–7 mm thick; cups (3–) 4–5.7 cm broad, 3–4 cm deep, hemispheric to deeply saucer-shaped, tomentose, the middle and outer scales much thickened, loosely appressed, the inner scales with narrow appressed tapering tips 5–10 mm long, 1–2 mm wide at base; acorns depressed-globose, 3–4.5 cm wide, about 3 cm high, one-third to one-half included.

This beautiful tree is a member of a small group of oaks with large leaves and very large fruits, mostly confined to Central America and the Atlantic slope of Mexico. No other species of the group seems to be known west of the isthmus of Tehuantepec, and the discovery of *Q. oocarpa* in Jalisco was quite unexpected.

Quercus peduncularis Née, An. Ci. Nat. 3: 270. 1801. *Quercus dolichopus* Warb. Kew Bull. 1939: 87. 1939.

Mountainsides, humid ravines, barrancas, sparsely wooded grassy slopes, in pine-oak forest or with other oaks, or in mesophytic forest with *Carpinus, Magnolia,* and *Podocarpus,* chiefly on the Pacific slope, 600–1700 m. 15 km south of Talpa (*Rzedowski 15070*); above La Cuesta, below the pass to Talpa (*Rzedowski 15119*); Cerro el Tecolote, Casimiro Castillo (*Córdoba M. 2006*); vicinity of Autlán (southwest of Autlán, *Wilbur 1422*; above Ahuacapán, *McVaugh 19591, Rzedowski 14543*); Tecalitlán (*Rzedowski 15316*); Coalcomán (Puerto Zarzamora, *Hinton 12245*; Salitre, *Rzedowski 16700*). Jalisco, Michoacán, Edo. de México (Temascaltepec, *Hinton 6378*!, type of *Q. dolichopus*), Guerrero (beyond the Río Mezcala [Balsas], on the road from Acapulco to México, *Née*, the type), Oaxaca, Veracruz; Chiapas and Central America. Little known except from Guerrero eastward.

A large forest tree, up to 15–18 m high, with trunk 50–75 cm in diameter and coarsely furrowed soft dark bark; branchlets 1.5–3 (–5) mm thick, at first densely but rather loosely tomentose, ultimately glabrescent, often becoming glabrous the second year, reddish brown, with numerous pale lenticels; buds (2–) 4–5 mm long, ovoid or

Fig. 28. *Quercus peduncularis.* Leafy twig, × ½, with peduncle and cups, *McVaugh 19591* (Jalisco); leaves, × ½, left to right, *Rzedowski 14541* (Jalisco), *Wilbur & Wilbur 1422* (Jalisco), *Rzedowski 16700* (Michoacán); hair from lower leaf-surface, much enlarged.

narrower, at first sparsely tomentose, finally brown, lustrous, the scales thinly ciliate; stipules 5–9 mm long, subulate or linear, pilose, often persistent most of the first season; leaves thick and leathery, obovate to oblanceolate or elliptic, (6–) 8–12 (–25) cm long, (2.5–) 4–7 (–12.5) cm wide, broadly rounded to obtuse or abruptly acute at apex, usually considerably narrowed from above the middle to the cordate or abruptly rounded base; margins cartilaginous-thickened and somewhat revolute, undulately low-toothed, denticulate, or coarsely serrate, usually with 5–12 strong teeth on each side, the teeth sometimes larger and sharper above the middle of the leaf, but usually extending well below the middle, and only the base of the blade entire; veins about 10–12 on each side, straight and ascending, passing directly into the stronger teeth, much branched and anastomosing near the margins; upper surface green but thinly tomentulose or stellate when young, at maturity hard, dark green, somewhat lustrous, rugulose, the veins and larger veinlets impressed, the finest veinlets pale, slightly convex; lower surface pale-tomentulose when young, at maturity loosely hairy, the hairs more or less erect and evidently stalked, nearly confined to the veins and larger veinlets, exposing the gray-green or glaucous, bullate and papillose epidermis; primary and secondary veins pale, strongly elevated, conspicuous; petioles 3–5 (–10) mm long, 1–2 (–3) mm thick, dark reddish brown, tomentose or glabrescent; staminate aments 4–7 cm long, loosely flowered, pilose, the anthers 1.3 mm long, coarsely pilose with long simple hairs, after opening much flattened, nearly round, 0.8–1 mm long; pistillate aments (1–) 5–7 cm long, bearing 2–4 (–8) flowers scattered near the end of the dark, slender, yellow-pilose peduncle 1–2 mm thick; fruit annual, solitary or several, characteristically sessile near the end of the slender peduncle; cup hemispheric or shallower, 15–20 mm broad, the scales yellowish-pubescent or grayish, somewhat thickened basally, the thin appressed tips tapering, obtuse, pale-pilose or glabrescent; acorns ovoid, about 15 mm long and 12 mm thick, pale or dark brown, one-third or only one-fourth included.

Quercus planipocula Trel. Mem. Nat. Acad. Sci. 20: 136. *pl. 259.* 1924.

Steep humid mountainsides, ravines, open basaltic hills, with other oaks, or in deciduous forest with *Carpinus, Magnolia,* and *Ilex,* 750–1300 m. Between Jalcocotán and Tepic (April, *McVaugh 12133, 12136*; September, *McVaugh 18960*); 35–40 km southeast of Tepic (March, *DeLeon 1608*; September, *Rzedowski 14296*); 15 km north of Compostela (*Rzedowski 14331, 14332*). Northern Nayarit (Pedro Paulo, *Rose 1970*!, the type) and adjacent Sinaloa; uplands of southern Nayarit; Guerrero (*Muller 9197*).

A large forest tree up to 12–20 m high, the trunk 60 cm in diameter or more, with hard furrowed black bark; branchlets 2–4 mm thick, densely yellowish-tomentose when young, soon glabrescent or the tomentum partially persistent for two or more seasons, the exposed surfaces grayish- or reddish brown, with small inconspicuous lenticels; buds 2.5–4 mm long, ovoid, light brown, at least the inner scales ciliate; stipules linear-attenuate, membranous, scarious, pilose, 8–10 mm long, deciduous before the leaves are full grown; leaves when young green or purple and loosely stellate-tomentose above, loosely and softly yellowish-gray-tomentose beneath, the hairs erect, about 8–12-branched, definitely stalked, covering but not obscuring the pale green, papillose and sparsely glandular-pilose epidermis; mature leaves rigidly coriaceous, dark green above, yellow-green and nearly glabrous beneath, elliptic to ovate or obovate, (6.5–) 9–15 (–23) cm long, (3–) 5–7 (–12) cm wide, 1.8–2.5 times as long as wide, from acute to acuminate to obtuse or even rounded at the usually aristate tip, rounded to deeply cordate at base; margins cartilaginous-thickened and somewhat revolute, rarely completely entire, usually with at least a few projecting aristae near the tip of the blade, often sinuate, with low aristate teeth or serrations, the teeth 1–7 on each side above the middle of the blade or sometimes below that,

Fig. 29. *Quercus planipocula.* Leafy twig, × ½, and twig with cups, × 1, *Rzedowski 14296*; large leaf, × ½, *McVaugh 12136*; leaves at right, × ½, above, *Rzedowski 14332*, below, *DeLeon 1608.* All from Nayarit.

the aristae 1–8 mm long; veins about 10–12 on each side, ascending, straight at base, all much-branched and anastomosing, or some of the upper ones passing directly into the stronger teeth; upper surface hard, dark green, glabrous except along the large veins; veins slightly impressed but convex, the small pale veinlets forming an elevated network of very sharp thin lines; lower surface yellow-green, finally glabrous or sparsely pubescent, markedly papillose, the pale elevated veins conspicuous, the small veinlets not so; petioles tomentose or finally glabrescent, (5–) 10–18 (–30) mm long, 1.5–2 mm thick or the enlarged reddish base up to 3.5 mm thick with concave inner face; staminate flowers unknown; pistillate flowers 1 or 2 near the end of a stout,

tomentose peduncle 1–1.5 cm long or less; fruit biennial, solitary or paired; cup saucer-shaped or very flat, 20–30 mm wide, 7–8 mm high, the margins very thick and rounded, deeply inrolled, the scales appressed, with thin canescent bases and obtusely deltoid or rounded pale brown stiff ciliate tips; acorns broadly ovoid, 15–20 mm long, 12–16 mm wide, half-included or much less.

This appears to be a characteristic species of the low mountains and foothills of the Pacific slope, in an area where relatively few other oaks occur. The mature leaves suggest by their shape and texture those of *Quercus candicans,* but that is a plant of pine and fir forests at much higher elevations, and is readily distinguished by the close white persistent tomentum of the lower leaf-surface and by the open, hemispheric acorn-cup.

Quercus vellifera Trel. Mem. Nat. Acad. Sci. 20: 73. *pl. 90.* 1924, based on an unnumbered collection made by Edward Palmer in "Western Mexico" in October, 1891, is unidentifiable, but is perhaps a synonym of *Q. planipocula.* The type and only known specimen consists of sterile leafy twigs evidently from a watersprout. Trelease included *Q. vellifera* among the *Reticulatae,* supposing it to be akin to what is called in this Flora *Quercus rugosa.* It is unlikely that Palmer would have encountered a montane species like *Q. rugosa* during his collecting in 1891, as in the latter part of that year he collected in the foothills of Sinaloa where *Q. planipocula* occurs, and where there are few other species of *Quercus.* The leaves in the type of *Q. vellifera* have texture and pubescence suggesting those of *Q. planipocula,* but are more broadly obovate and more coarsely toothed than any other known specimens of that species.

Quercus potosina Trel. Mem. Nat. Acad. Sci. 20: 84. *pl. 123.* 1924.

Rocky hills and canyons, exposed ridges and banks, with shrubs or junipers and other small oaks and forming a low dense woodland with few other species, 2000–2400 m. Rincón de Romos (El Pinal, Barr. de Barbechitos, *J. Hernández 2058*); Sierra del Laurel (*McVaugh & Koelz 190, 191, 192,* the typical sordid-tomentulose form with reddish branchlets and petioles, and obovate denticulate or dentate leaves); Ciudad García, Zacatecas (*collector unknown,* hb. Muller.); Hacienda Chinampas, 25 km west-southwest of Ojuelos (*McVaugh 17039*; the leaves oblong and serrate as in f. *aperta* Trel.); Paso de la Troje (*McVaugh 12039,* with more coarsely serrate leaves as in f. *exilis* Trel.); between Ojuelos and Lagos de Moreno (*Muller 9296*). Southern Chihuahua, ?Durango, southern Zacatecas, Aguascalientes, northern Jalisco, Guanajuato, San Luis Potosí (*Parry & Palmer 838*!, the type).

Typically a small tree 3–7 m high, with rounded crown, short trunk 15–30 cm thick, and flaking gray bark, sometimes shrubby, 2–3 m high; branchlets rather thick for the size of the plant, 1.5–3 mm thick, usually noticeably reddish, rather coarsely and loosely stellate-tomentose or -pilose, and glandular-granular, the sordid hairs persisting more than one season; lenticels inconspicuous on the dark twigs; buds reddish brown, appressed-hairy, 3–6 mm long, ovoid, acute; stipules filiform-subulate, 6–10 mm long, pilose, scarious, persistent about the terminal buds, the lower ones

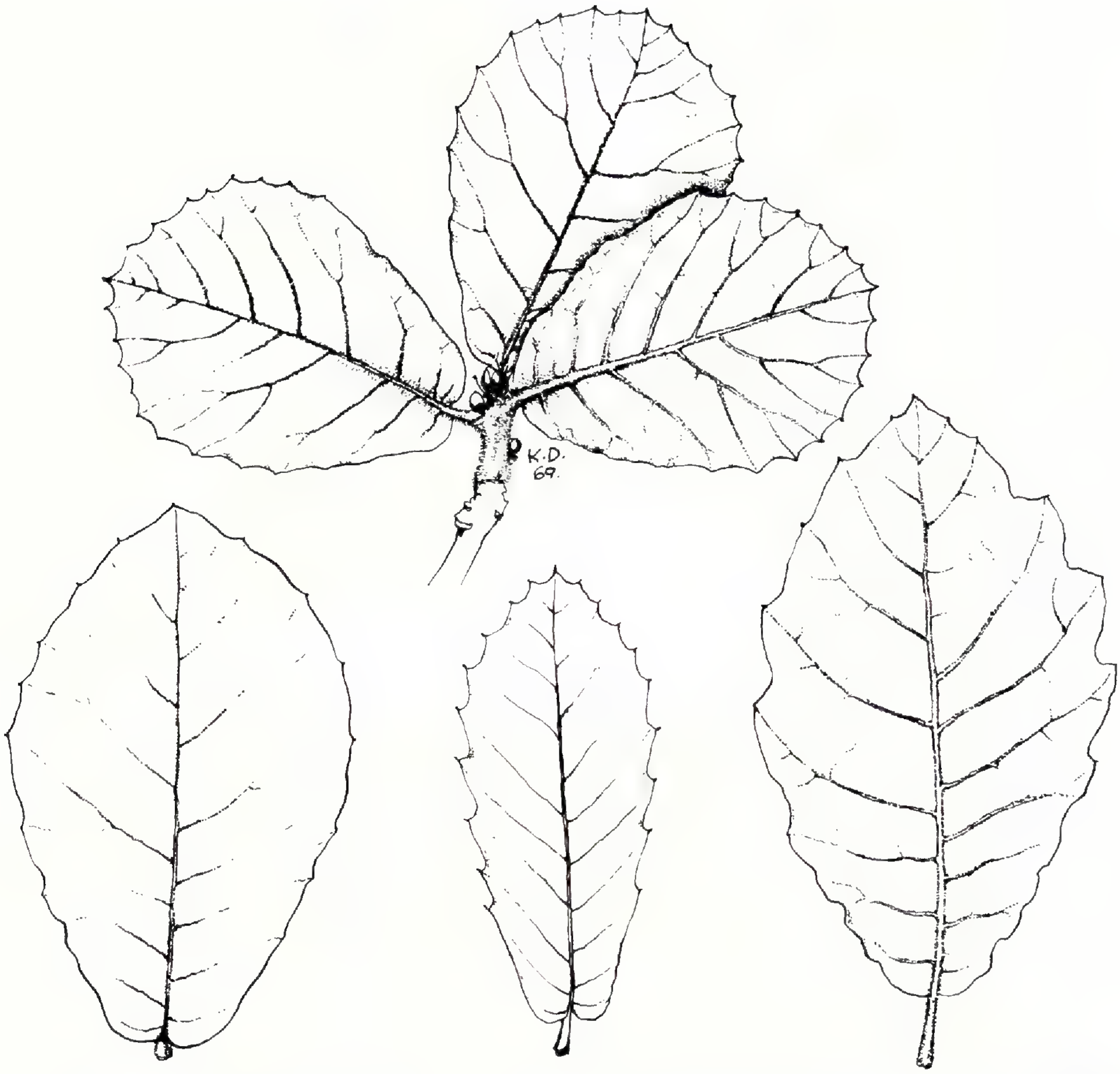

Fig. 30. *Quercus potosina,* × 1. Leafy twig, *McVaugh & Koelz 192* (Aguascalientes); leaves, left to right, *McVaugh & Koelz 191* (Aguascalientes), *McVaugh 17039, 12039* (both from northeastern Jalisco).

soon deciduous; young leaves often strongly yellowed beneath by the many vermiform glandular hairs, the upper surface bearing many small stellate hairs and scattered reddish glandular hairs; leaves tardily deciduous, the trees mostly leafless toward the end of the dry season; mature leaves rigidly coriaceous, often yellowish green with reddish veins and petioles, the blades almost always denticulate or serrulate, obovate to suborbicular, oblong, or oblanceolate, (2–) 3–6 (–9) cm long, (0.8–) 2–4 (–7) cm wide, 1.3–2 (–2.5) times as long as wide, broadly rounded or obtuse at apex (or appearing acute or subacute because of a large terminal mucronate tooth), usually markedly cordate-auriculate at base; margins thickened and somewhat revolute at least between the teeth; teeth 4–13 (usually 7 or 8) on each side, extending from the middle or below to the tip of the blade, sometimes nearly to the base and the lower ones then smaller, all or nearly all tipped with a stout mucro up to about 0.5 mm long; serrations sharp and distinct, up to 1–2 mm high, or some or all of the teeth recognizable by the terminal mucros only, the margin only slightly incurved between them; veins about 7–10 on each side, ascending, passing directly into the teeth when these are present, or often branching at the middle or a little above, and sending branches into two adjacent teeth; upper leaf-surface hard and somewhat lustrous, dark green or yellowish green, glabrescent in age but usually retaining many small stellate hairs in sheltered places, quite flat or moderately rugulose, the veins and veinlets sometimes impressed, the smallest veinlets forming a pale, elevated network; lower

surface slightly paler, the epidermis pale, glaucous, nearly smooth, sometimes perceptibly papillose at magnifications of 15×–25×, usually bearing many traces of the amber-colored glandular hairs, and partly covered but usually not obscured by numerous, sessile, several-branched and collapsed or contorted pale stellate hairs; primary veins, and small ladder-like series of secondary veins, elevated and usually conspicuous, the smallest veinlets not or scarcely discernible; petioles 3–6 (–9) mm long, usually reddish, pilose or tomentulose, usually depressed between the auricles of the leaf-base; staminate aments 3–5 cm long or more, interrupted, tomentulose, the perianth pilose, 3 mm wide when expanded, the anthers about 1 mm long, glabrous; pistillate flowers 2–10, scattered or clustered on a tomentose peduncle 1–3 cm long, 1.5 mm thick; fruit annual, solitary or paired, usually 1 cm or less from the base of the peduncle; cup hemispheric, 12–20 mm wide, the scales with thickened canescent bases and rather coarse, tapering, blunt, loosely ascending tips; acorn ovoid, 15–18 mm long, half-included.

Occasional specimens from northern Jalisco (e.g. *Rzedowski 17700,* from Mezquitic), and from adjacent Zacatecas and Aguascalientes, resemble *Quercus potosina* except in having densely pale-tomentose twigs and leaves somewhat like those of *Q. chihuahuensis.*

Quercus praeco Trel. Mem. Nat. Acad. Sci. 20: 88. *pl. 139.* 1924.

Rocky rhyolitic hills, ravines, dry oak woodland, or with *Dodonaea* and other oaks in grassland, 1000–2100 m. Between Huejuquilla and Mezquitic, where one of the very common oaks (*Rose 2590*!, the type; *McVaugh 17750, 17752, 17755*); Rancho Viejo, Mpio. de Huejuquilla (*Rzedowski 17586*); Sierra de Nayarit, northwest of Mesa del Nayar

Fig. 31. *Quercus praeco.* Leaves, × ½, left to right, *Rzedowski 26140* (northern Jalisco), *Feddema 1443* (northern Nayarit); leafy twig, × ½, and twig with cups, × 1, *Rzedowski 17586* (northern Jalisco).

(*Norris 14261*); 10 km east of Jesús María (San Isidro, *Feddema 1443*); San Martín de Bolaños (8 km northwest of El Platanar, *Rzedowski 26140*); summits between Jalpa and Tlaltenango (*McVaugh 25593*). Otherwise unknown.

A short-trunked tree 5–7 m high, with trunk 30–50 cm in diameter and brittle stubby branches; branchlets 2–4 mm thick, including the dense yellowish-white tomentum that persists for several years; buds 3–4 mm long, ovoid, obtuse, tomentose at least at base; stipules 5–9 mm long, pilose, scarious, some or all of them persistent the first year and, as shreds, sometimes part of a second year; leaves deciduous, bicolorous, obovate to elliptic-obovate, 4–8 (–14) cm long, (1.5–) 2.5–5 (–8) cm wide, (1.6–) 2–2.5 times as long as wide, rounded or obtuse (seldom subacute) at apex, more gradually narrowed to an abruptly rounded or subcordate base; margins thickened and markedly revolute, sinuate-dentate to subentire but always with a few low mucros, or (usually) coarsely toothed above the middle or nearly to the base, the teeth 4–7 (–10) on each side, bluntly mucronate, broadly triangular and 1–3 mm high, or rounded and lobelike, up to 1 cm high and wide; veins 6–12 on each side including some short intermediates, ascending, passing directly into the teeth or marginal mucros if these are present, or the lower ones arching and anastomosing; upper leaf-surface green and somewhat lustrous but sometimes appearing dull because of the persistent covering of ascending or erect, often overlapping, sessile, several-branched hairs; primary and (especially) secondary veins impressed at maturity, the surface markedly rugulose; smallest veinlets pale but usually inconspicuous; lower surface closely pale- or yellowish-tomentose or stellate-pubescent with sessile, spreading and overlapping 8–10-branched hairs of different sizes; epidermis pale green, papillose, wrinkled but scarcely bullate; primary and secondary veins much elevated, conspicuous, the smallest veinlets covered by the hairs; petioles 4–8 (–11) mm long, tomentose, 2–2.5 mm thick including the tomentum; staminate flowers unknown; pistillate flowers and fruits 1–5, more or less clustered toward the end of a tomentose peduncle (1–) 3–7 cm long, 1.5–2 mm thick; fruit annual; cups 15–22 mm wide, hemispheric or somewhat flared out at the rounded and somewhat inrolled margin 2–3 mm thick; scales with convex-thickened canescent-tomentose bases and brown thin bluntly triangular tips, these erect and loosely appressed in the middle scales, strongly incurved in the inner; acorn ovoid, 17–20 mm long, 11–15 mm thick, about half included.

Trelease did not explain why he used the epithet "Praeco" for this species. In classical Latin the word meant a public crier or a herald; perhaps Trelease's intention was to emphasize that the species was unusually distinctive in some respect.

Quercus praineana Trel. Mem. Nat. Acad. Sci. 20: 138. *pl. 262.* 1924. *Quercus aequivenulosa* Trel. Mem. Nat. Acad. Sci. 20: 138. *pl. 261, lower figure.* 1924. *Quercus coffeaecolor* Trel. Mem. Nat. Acad. Sci. 20: 137. *pl. 261, upper figure.* 1924.

Mountainsides and summits, dry hillsides, in pine-oak forests, 1500–2500 m, little known. Santa Teresa (*Rose 2231*, type of *Q. aequivenulosa*); Sierra de Nayarit, northwest of Mesa del Nayar (*Norris 14242, 14688*); Ixtlán del Río (Cerro Alto, *Reyes P. 2129*); Etzatlán, 1900 m (*Pringle 8854*!, the type); San Sebastián (Real Alto, *Mexia 1741*); Talpa de Allende (*McVaugh 14403*). Sinaloa (Colomas, *Rose 1758*!, type of *Q. coffeaecolor*), Nayarit, western Jalisco. "Encino de Asta," "encino colorado."

Fig. 32. *Quercus praineana.* Leafy twig, × ½, *Pringle 8854* (Jalisco); leaves, × ½, left to right, *Norris 14242, Norris 14242* (northern Nayarit), *McVaugh 14403* (western Jalisco); cups and acorn, × 1, left to right, *Norris 14242, 14688* (northern Nayarit).

A tree up to 8–12 m high, with trunk up to 25–30 cm in diameter; branchlets at maturity glabrous, 1.5–2.5 mm thick, purplish-brown, pruinose-glaucous, with many pale lenticels; buds 3.5–5 mm long, ovoid, subacute, reddish brown, glabrous except the ciliate margins of the scales, or the inner scales pilose; stipules not seen, presumably all deciduous before the leaves mature; immature foliage not seen; leaves probably deciduous, at maturity very stiff, drying yellowish green above and pale yellowish brown beneath, elliptic or elliptic-ovate or slightly obovate, (5–) 7–12 cm long, (2–) 3–5 (–7.5) cm wide, 1.5–2.5 times as long as wide, rounded to retuse at apex or (even on the same plant), short-acuminate or abruptly acute and sometimes aristate; blades gradually narrowed to a broadly rounded or truncate base, sometimes acute or more often shallowly subcordate; margins thickened and very slightly revolute, sometimes undulate but otherwise entire as far as known; and without aristae except the terminal one; veins 6–8 on each side, ascending, arching or forking and anastomosing well within the margin; upper leaf-surface hard, lustrous, glabrous, the large veins and veinlets pale, elevated (convex) in dry leaves, forming a network usually apparent to the unaided eye; lower surface lustrous, glabrous except for tufts of erect stellate hairs in slightly depressed areas in the axils of the large veins; primary veins pale, convex, the thick small veinlets forming a network usually perceptibly paler than the brown, papillose areas between them; papillae on the veinlets, if any, less evident than those on the intervening areas; petioles 8–24 mm long, glabrous, pruinose, wrinkling in drying, 1.5–3 mm thick at base; staminate aments unknown; pistillate flowers 1–3, glabrous except for the ciliate margins of the scales, nearly sessile, or

lateral and terminal on a stout glabrous peduncle up to 1 cm long, 1.5–2 mm thick; fruit biennial, solitary or 2–3 together on a very short stalk, the cup 10–15 mm in diameter, rather shallow, 4–6 mm high, the thin, brown, silvery-canescent scales with tightly appressed broadly obtuse erect or incurved tips; acorn canescent, short-ovoid, 8–12 mm long, 7–10 mm thick, one-third or less included.

The description of *Q. praineana* is based on the types of the three species regarded as synonymous, and three additional specimens, that collected by Reyes at Cerro Alto, and those by Norris. Apparently no other undoubted examples are known. The other two collections cited above, *Mexia 1741* and *McVaugh 14403,* can hardly be referred to any other known species, but are atypical of *Q. praineana.* The buds are 6–8 mm long, long-acute, and pilose; the branchlets and petioles are rather persistently pubescent; the leaves are oblong-elliptic, rounded at apex and rather deeply cordate at base. The buds suggest those of *Q. coccolobifolia* rather than *Q. praineana*; the leaf-shape and texture, and the pubescence, suggest *Q. aristata.*

Quercus resinosa Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 182. 1854. *Quercus macrophylla* sensu Trel. Mem. Nat. Acad. Sci. 20: 63. 1924, not *Q. macrophylla* Née.

Rocky or gravelly hills and ridges, mountainsides, semi-arid grasslands with scattered trees, often in almost pure stands, forming open woodlands sometimes with other oaks or with pines, (1150–) 1500–2300 m, the fruit ripening in October and November, the staminate flowers produced in April and May as the new leaves develop. Southernmost Durango (*Rose,* 13 Aug 1897); near Santa Teresa (*Rose 2188*); Sierra de Nayarit, west of Mesa del Nayar (*Norris 14590*); Monte Escobedo (*McVaugh 12010*); 15 km northeast of Huejuquilla (*Rzedowski 9110*); Tlaltenango (*Straw & Forman 1804*); Sierra de Nochistlán (*Martínez 409*); Sierra del Laurel (*McVaugh & Koelz 163, 164*); Sierra Madre west of Bolaños (*Rose 3001*); Santa María del Oro (*Pérez 2066*); "El Ocote," near Ixtlán (*Mexia 796*); San Sebastián (*Mexia 1708*); northeast of Talpa (*McVaugh 20343*); San Miguel de la Sierra (*McVaugh 21566*); Magdalena (*Muller 9058*); 25 km west of Ameca (La Estanzuela, *McVaugh 12179*); Chiquilistlán (*Jones 441*); Guadalajara (*?Pringle 5357, ?6220*); Milpillas to Escalón (*McVaugh 11969*); Tepatitlán (*McVaugh 17397*); 35 km east of Arandas (*McVaugh 24298*); Ayo el Chico (*McVaugh 17158*); Cerro de los Gallos (*McVaugh 17082*); Coalcomán (*Hinton 12802*). ?Durango (*Seemann 1972*, the type), southern Zacatecas, Aguascalientes, Jalisco, Michoacán, Guanajuato, San Luis Potosí.

A tree 6–10 (–15) m high, often with short trunk 30–70 cm in diameter, thick gray flaking bark, and broad low crown; branchlets usually very thick and stubby, 4–10 mm thick, heavily and densely yellowish- or sordid-tomentose, the hairs at first interspersed with erect simple reddish glandular hairs, at length blackening or fading and persisting several years; bark gray-brown to black, the lenticels numerous but often inconspicuous; leaf-scars 5–8 mm wide, 2–3 (–4) mm high; buds 3–6 mm long, seldom prominent, seeming small for the size of the leaves and twigs, ovoid, acute, pale brown, the scales long-ciliate; stipules 8–15 mm long, linear to subulate, densely pilose, deciduous, or on terminal buds and slow-growing twigs persistent at least as shreds for

Fig. 33. *Quercus resinosa*, × ½. Leafy twig, *Gentry 10875* (Nayarit); twig to show leaf-scars, *McVaugh 20343* (Jalisco); tip of toothed leaf, *McVaugh & Koelz 163* (Aguascalientes).

two or more seasons; leaves deciduous in April or May as the new ones develop, often not fully mature until August; young leaves tomentose on both sides, reddened above by the covering of straight vermiform glandular hairs longer than the pale stellate hairs, the lower surface densely pale-tomentose, the glandular hairs abundant on the veins only; mature leaves deciduous, very large and stiff, pale-tomentose beneath, rather broadly obovate, (10–) 15–30 (–50) cm long, (5–) 8–20 (–25) cm wide, 1.2–2 times as long as wide, rather abruptly narrowed to a broadly rounded or less often an obtuse or obtusely acuminate apex, more gradually rounded to a narrow, tapering, abruptly curving or sometimes subcordate base; margins usually coarsely puckered, thickened and definitely revolute, sinuate or coarsely sinuate-dentate, the teeth about 8–18 on each side, mostly low, rounded and asymmetric, callose-tipped, but the mucros mostly turned under with the revolute margin, or thickened on the lower leaf-surface, and scarcely visible from above; veins about 10–20 on each side, ascending, mostly straight and parallel without conspicuous intermediates, passing directly into the teeth when these are present, the others (often only 3–4 at the base of the blade) anastomosing near the margins; upper surface hard, somewhat lustrous, green, persistently but rather thinly stellate-pubescent, rugulose, the large veins strong and well marked but not or scarcely impressed, the secondary veins impressed and the tiny pale veinlets convex; lower surface densely pale-tomentose to thinly and softly pilose, the sessile, overlapping hairs often but not always obscuring the green, papillose, glandular, wrinkled but not strongly bullate epidermis; primary and secondary veins forming a strong raised reticulum, the tiny veinlets not discernible; petioles 4–6 (–10) mm long, 4–6 mm thick at the enlarged base, tomentose, often depressed between the infolded sides of the leaf-base; staminate aments 7–15 (–20) cm long, interrupted, pilose and glandular, the perianth pilose without, at length subrotate, 3.5–4 mm wide, the pilose anthers 1.6–1.8 mm long; pistillate flowers 1–5 (–10), clustered or scattered along a tomentose peduncle 2–5 cm long; fruit annual, 1–3 usually maturing, scattered along a peduncle up to 15–20 cm long, 2–3 mm thick; cups hemispheric or slightly deeper, 15–25 mm wide, densely gray-tomentose within, the scales gray-tomentose without, coarsely thickened at base, the brown triangular obtuse tips ascending but usually forced apart by the basal thickenings; acorns ovoid, 15–32 mm long, 15–20 mm thick, thin-walled, wrinkled in drying except when fully mature, about one-third included.

A characteristic species of oak and pine forests on dry interior uplands, often the dominant species in such forests and sometimes the only abundant tree. The very broad stiff leaves, sometimes reaching a length of more than 50 cm, are larger than those of any other species except *Quercus magnoliifolia*, with which *Q. resinosa* has often been confused (the name *Quercus macrophylla* has at different times been applied to both species). *Q. magnoliifolia* is easily distinguished by its glabrous or thinly pubescent twigs and petioles. Like *Q. resinosa* it may form almost pure woodlands on dry hills, but unlike *Q. resinosa* it is not a plant of the Central Plateau. It is found primarily on the Pacific slope, at elevations from 800 m to about 2200 m, or sometimes as low as about 375 m above sea level.

Quercus rugosa Née, An. Ci. Nat. 3: 275. 1801. *Quercus reticulata* Humb. & Bonpl. Pl. Aequinoct. 2: [35]40. *pl. 86.* 1809. *Quercus conglomerata* Trel. Mem. Nat. Acad. Sci. 20: 77. *pl. 106.* 1924. *Quercus durangensis* Trel. Mem. Nat. Acad. Sci. 20: 73. *pl. 91.* 1924. *Quercus rhodophlebia* Trel. Mem. Nat. Acad. Sci. 20: 74. *pl. 95.* 1924. *Quercus suchiensis* Warb. Kew Bull. 1933: 188. 1933.

Mountain forests, cool steep slopes, barrancas, with pines and other oaks or in fir forest, 2000–2600 m, the fruit ripening November to March.

Fig. 34. *Quercus rugosa.* Leafy twig, × ½, *Mexia 1591* (Jalisco); peduncle with cups, × 1, *McVaugh 10131* (Jalisco); large leaf, × ½, *Windler 2963* (Michoacán); small leaf, × ½, *McVaugh & Koelz 194* (Augascalientes); portion of leaf-margin with mucro, much enlarged.

Ciudad García (*M. Martínez 156*); Sierra del Laurel, the common oak on the upper slopes (*McVaugh & Koelz 194*); Plateado (*Rose 2806*!, type of *Q. rhodophlebia*); Sierra Madre west of Bolaños (*Rose 2998*!, type of *Q. rhodophlebia* f. *concava*); San Sebastián (Real Alto, 2500 m, *Mexia 1591*); Nevado de Colima, the common oak from 2500–2550 m (*McVaugh 12921, 10131*); Tecalitlán (*J. P. Gómez 167*); Coalcomán (southwest of Dos Aguas, *McVaugh 22787*); Tancítaro (*Leavenworth 261*). Primarily a plant of the Sierra Volcánica Transversal and the Sierra Madre Occidental, known in Nueva Galicia only in a few isolated high-mountain areas. Western Texas, southern Arizona, Coahuila, Chihuahua, Durango (*Mathews*!, type of *Q. durangensis*), southern Zacatecas, Aguascalientes, Jalisco, Michoacán (Tlalpuxahua, *Hartweg 429,* type of *Q. conglomerata*; "Suchi," México or Michoacán, *Heatley,* type of *Q. suchiensis*), Guanajuato (Santa Rosa, *Bonpland,* type of *Q. reticulata*), Edo. de México ("en los bosques de Huisquiluca y Ocuila, y entre los Pinos que hay desde Mexico al Santo Christo de Chalma," *Née,* the type), D. F., Hidalgo, Puebla, Veracruz. "Encino avellano" (Jalisco).

A large forest tree, often up to 20 m high or more, with trunk 1 m or more in diameter; branchlets rather stout, 2–4 mm thick, when young glandular and thinly tomentulose, soon glabrescent, often nearly glabrous after one season, finally gray-

brown with numerous pale lenticels; buds 2–4 mm long, ovoid, obtuse, pale brown, inconspicuous; stipules scarious, silky-pilose, 8–12 mm long, linear or the lower ones oblanceolate, deciduous before the leaves are half-grown, or persistent about the terminal nodes at least as shreds; young leaves noticeably bicolorous, green and sparingly pubescent above from the first, bearing many very short thick reddish glandular hairs, the lower surface densely pale-tomentose, glandular especially on the veins; leaves evergreen or very tardily deciduous, at maturity very thick and rigid, often noticeably cupped (i.e. concave beneath), strongly rugose, obovate to elliptic-obovate or almost suborbicular, (5–) 8–15 (–20) cm long, (3–) 5–8 (–13) cm wide, 1.3–2 times as long as wide, broadly obtuse or rounded at apex, tapered or rather broadly rounded to a cordate base, irregularly denticulate or serrate to subentire; margins thickened but often not appreciably revolute, sometimes split or folded under in pressing; teeth 5–15 on each side, more abundant above the middle of the blade but often extending nearly to the base, usually low and obtuse, varying to sharp serrations up to 3–6 mm high, or much reduced and the margins merely undulate, but at least a few teeth in almost all leaves bearing an erect stout mucro up to 1 mm long; veins about 8–12 on each side, ascending, passing directly into the teeth or forking and the branches passing into adjacent teeth, or especially the lower ones branching and anastomosing well within the margin; upper leaf-surface hard, somewhat lustrous, essentially glabrous except near the base of the midvein, usually drying pale yellowish green, strongly rugulose, the primary and secondary veins impressed, the smallest veinlets thick, elevated, forming a pale network on a green background; lower surface densely to very thinly pilose with soft crumpled and often tangled 15–20-branched hairs up to 1 mm long, and copiously glandular-puberulent with much smaller, simple, vermiform, amber-colored or pale reddish hairs; pubescence often covering but seldom completely obscuring the waxy-glaucous, papillose and at maturity strongly bullate epidermis; primary veins, and at least the larger secondaries, elevated almost their whole thickness above the surface, forming with the smaller veins a strong pale network, the smallest veinlets not discernible among the bullae; petioles 5–10 (–15) mm long, 2–4 mm thick, pubescent, strongly depressed between the infolded sides of the leaf-base; staminate aments 3–6 cm long, rather loosely flowered, tomentose; perianth silky-pilose, 2.5–3 mm wide; anthers glabrous, 1.3–1.6 mm long; pistillate flowers 2–12, mostly crowded along the distal half of a long slender peduncle; fruit annual, solitary or in 2's or 3's toward the end of a pubescent peduncle 1–2 mm thick, (2–) 6–10 cm long; cups 10–15 mm wide, 5–12 mm high, hemispheric or the base somewhat constricted; scales on young cups characteristically loosely appressed or somewhat spreading, the mature scales with brown or blackish thickened pubescent bases and thin brown obtusely triangular tips; acorns ovoid, often narrow and pointed, (10–) 15–25 mm long, 8–12 (–15) mm thick, light brown, one-third to one-half included.

Quercus salicifolia Née, An. Ci. Nat. 3: 265. 1801. *Quercus tahuasalana* Trel. Mem. Nat. Acad. Sci. 20: 154. *pl. 302, upper figure.* 1924. *?Quercus acapulcensis* Trel. Mem. Nat. Acad. Sci. 20: 153. *pl. 302, lower figure.* 1924. *?Quercus flagellifera* Trel. Mem. Nat. Acad. Sci. 20: 162. *pl. 319.* 1924.

Steep forested mountainsides and barrancas, in tropical subdeciduous forest with *Inga, Saurauia* and *Alchornea,* with *Carpinus, Cornus, Podocarpus,* and other species of oaks, or in forest of firs and deciduous trees, sometimes forming nearly pure stands, 600–2000 m, mountains of the Pacific slope. In barranca-forests south and southeast of Talpa (*McVaugh 21422, 21520*); west of Ayutla (San Miguel de la Sierra, *McVaugh 22026*); "Coalcomán" (Chinicuila) (Huizontla, *Hinton 12654*); Hda. Coahuayula (*?Emrick 108*). Jalisco, Michoacán (Tahuazal, *Rzedowski*

Fig. 35. *Quercus salicifolia*, × ½. Leafy twig, *McVaugh 22026* (Jalisco); leaves, left to right, *McVaugh 20270* (Jalisco), *Rzedowski & McVaugh 34* (Guerrero), *McVaugh 22642* (Michoacán).

26615; Langlassé 211!*, type of *Q. tahuasalana*), Guerrero ("Acapulco," *Née*, the type; *Palmer 334*!, type of *Q. acapulcensis*), Veracruz, ?Oaxaca; Chiapas and Central America (Guatemala, *Cook & Griggs 607*, type of *Q. flagellifera*).

A tree 10–15 (–25) m high, with trunk 30–50 (–100) cm in diameter; branchlets 1–2.5 mm thick, at first thinly and minutely stellate-pubescent, finally glabrescent, dark reddish brown with inconspicuous lenticels; buds 2.5–4 mm long, ovoid, acute, brown, the scales ciliate; stipules filiform or linear, 5 mm long, scarious, pilose, deciduous before the leaves are half-grown, or weakly persistent on the terminal buds; leaves when very young thinly and minutely stellate-pubescent, very soon becoming glabrous, completely eglandular from the first, or with few tiny reddish glands above, near the midvein; leaves deciduous as the young growth appears in November or December, at maturity coriaceous, green, a little paler beneath, elliptic or elliptic-lanceolate, (5–) 7–12 (–20) cm long, (1–) 1.5–4 cm wide, 5–6 (–8) times as long as wide, tapering to an acute or usually attenuate and aristate tip, about equally tapering toward the narrow, attenuate to narrowly auriculate or abruptly rounded base; margins thickened but scarcely revolute, always entire, often much crisped (puckered) and appearing undulate; veins numerous and irregular, about 15–25 on each side, those arising from the midvein of several sizes and variously oriented, the larger ones usually not well differentiated from the smaller intermediate ones, all branching and

*Cited by Trelease as 217.

anastomosing well within the margins; upper surface hard, scarcely lustrous, bearing a few minute stellate hairs or (usually) quite glabrous except at the base of the midvein, flat, the veins convex, forming with the tiny veinlets a pale sharp reticulum; lower surface pale green, papillose but otherwise smooth and somewhat lustrous, essentially glabrous or occasionally with tufts of coarse pale stipitate hairs in the axils of the larger veins; veins pale and elevated, the smallest veinlets evident, a little heavier and less sharply lined than those on the upper surface; petioles 1–5 (–9) mm long, pubescent; staminate aments 4–6 (–10) cm long, loosely flowered, thinly pubescent, the perianth broadly campanulate, 2 mm high, its obtuse lobes long-pilose; anthers sparingly pilose, 1.3 mm long; pistillate flowers 1–4, on tomentulose peduncles 1–4 mm long; fruit biennial, solitary or paired, the peduncle up to 1 cm long; cup hemispheric or shallower, 10–12 (–16) mm wide, thin-margined, the scales hardly thickened at base, pale brown, yellowish-canescent, with tightly appressed, broad, obtuse, glabrescent tips; acorns ovoid, about 12–15 mm long, 9–12 mm thick, one-third included.

Née gave the type-locality of this species as Acapulco, and listed it as if it grew with other species near the coast, as e.g. *Hymenaea courbaril, Guillandina bonduc, Crescentia cujete* and *Rhizophora mangle.* Palmer's specimen of *Q. acapulcensis* is also labelled as from near Acapulco. Apparently there are no modern records of this plant from so near the coast, and it may be that both Palmer and Née obtained their specimens from inland localities. In Michoacán, according to Hinton, *Q. salicifolia* occurs at an elevation of about 1000 m, with an altitudinal range of only about 100 m. Further east in the same state, between Arteaga and Playa Azul, it is locally abundant between 600 and 800 m elevation. Modern collections from Guerrero range in elevation from 600 to 700 m, occasionally as high as 1900 m.

The type of *Q. acapulcensis* had oblanceolate leaves up to 13–16 cm long, 4–5 cm wide. Modern collections (*Muller 9190*) from about 50 km north of Acapulco probably represent the same taxon. In these the leaves vary from 10–20 cm in length and 3–6 cm in width. Except that the blades are mostly 3–4 times as long as wide (i.e. broadly elliptic to nearly obovate) and the large veins may be slightly impressed above, and stronger than the intermediate veins, it is hard to separate these specimens from the narrower-leaved plants of *Q. salicifolia* that occur in the same region.

Nothing exactly like *Q. acapulcensis* has been found in Nueva Galicia, but in a few localities in western and southern Jalisco there is an oak that may be mistaken for it. In the barrancas south of Talpa, associated with *Carpinus, Matudaea, Podocarpus* and *Magnolia,* and in similar habitats with pine, fir and other oaks in the Sierra de Manantlán southeast of Autlán, at elevations of 1200–2400 m, it is a large tree up to 30 m high and 1 m in diameter (*McVaugh 21409, 21410, 21411,* a series selected to show leaf variability; *10258*).

In this plant the young leaves and branchlets are very loosely tomentulose, quite without glands, soon glabrescent. The mature leaves are larger than those of *Q. salicifolia,* often 15–23 cm long, 3–5 cm wide, variable in width, 3.5–6 times as long as wide; the margins vary from quite entire to coarsely serrate with long-aristate teeth as in *Quercus acutifolia*; the petioles in the more strongly serrate leaves vary from 1.5 to 2 cm in length, and in the more nearly entire forms they may be as short

as 2–3 mm; the large foliar veins may be slightly impressed above, and are unlike those of *Q. salicifolia* in that the intermediates are few and poorly developed. The variability in these populations, particularly in the one near Talpa, suggests the possibility of hybridization, e.g. between such species as *Q. salicifolia,* which is locally abundant, and *Q. acutifolia,* which is apparently far less common.

Another plant, common on a number of south- and west-facing foothill slopes in western Jalisco, is apparently a markedly pubescent and glandular extreme of *Q. salicifolia.* In October and November its yellowing leaves may color entire hillsides. Its leaves are indistinguishable by shape alone from those of typical *Q. salicifolia,* but bear on the lower surfaces many simple, short, amber-colored glandular hairs that are at least partly persistent till the leaves fall; the branchlets are tomentose at least the first season but sparingly it at all glandular; the upper leaf-surface even in old leaves usually bears scattered hairs, and the smallest veinlets on the lower surface are hardly discernible. This is apparently the same as *Quercus mexicana* var. *glabrata* Seemann, Bot. Voy. Herald 332. 1856 ("Sierra Madre" [of Sinaloa, Durango, or Nayarit], *Seemann 1974,* the type):

Hillsides, mountain ridges, stream-valleys, barrancas in pine-oak forest or in deciduous forest with *Juglans, Fraxinus, Prunus* and other oaks, (250–) 1000–1500 m. About 30 km west of Guadalajara (*Rzedowski 15491*); San Sebastián (*Mexia 1700*); Cerro El Tecolote, Casimiro Castillo (*Córdoba M. 2072*); Sierra de Manantlán, ca. 40 km southeast of Autlán (*McVaugh 23251*); Cabo Corrientes, southeast of El Tuito (*McVaugh 25456*); above La Cuesta, below the pass to Talpa (*McVaugh 20270, Rzedowski 15128*). Western Durango, northern Nayarit, or adjacent Sinaloa (*Seemann 1974,* type of *Q. mexicana* var. *glabrata*); Jalisco. "Encino de Asta"; "encino de hoja menuda."

Quercus scytophylla Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 180. 1854. *Quercus campanariensis* Trel. Mem. Nat. Acad. Sci. 20: 126. *pl. 228.* 1924. *Quercus epileuca* Trel. Mem. Nat. Acad. Sci. 20: 126. *pl. 229, upper figure.* 1924. *?Quercus incarnata* Trel. Mem. Nat. Acad. Sci. 20: 126. *pl. 230, upper figure.* 1924.

Steep humid forested mountainsides, with pines and other oaks, or in barranca-forest with other broad-leaved trees or with firs, 1350–2500 m. West and south of Talpa de Allende (*McVaugh 14291, 21423*); 25–30 km southeast of Autlán (*McVaugh 13939*); Tecalitlán (*McVaugh 15032*); Coalcomán (Dos Aguas, *McVaugh 17838*). Chiefly in the mountains of the Pacific slope: Sonora (*Hartman 337,* type of *Q. epileuca*), ?Chihuahua (*Endlich 728b,* type of *Q. incarnata*), western Durango and adjacent Sinaloa, Jalisco, Michoacán (*Arsène 6004 bis*!, type of *Q. campanariensis*), Edo. de México, Guerrero, Oaxaca (*Liebmann,* the type). "Encino blanco" (Michoacán); "encino prieto" (Michoacán).

A large forest tree, up to 15–20 m high, the tree up to 0.5–1 m thick; branchlets 1–2.5 mm thick, at first scurfy-tomentulose, usually glabrescent by the end of the first season, reddish brown to nearly black, with numerous inconspicuous lenticels up to 1.2 mm long; buds 2.5–4 mm long, ovoid or ellipsoid, obtuse, brown, the scales

Fig. 36. *Quercus scytophylla,* × ½. Left to right, *McVaugh 14291, 15032, 14274.* All from Jalisco.

copiously ciliate-fringed; stipules falling before the leaves are half-grown, 4–5 mm long, oblanceolate, membranous, pubescent; leaves probably evergreen, very thick and rigid, chiefly obovate, varying to elliptic, oblanceolate, or seldom lanceolate, (5–) 8–12 (–17) cm long, (2–) 3–6 (–8) cm wide, 1.5–3 times as long as wide, tapering to an acute apex or with an acute terminal tooth forming a prominent tip, gradually narrowed from the middle or above to an acute or attenuate base or the sides sometimes gradually incurved to a somewhat rounded narrow base; margins cartilaginous-thickened and slightly revolute, rarely completely entire, usually bearing 1–4 (–7) aristate, deltoid to narrowly triangular, usually ascending teeth above the middle of the blade, the teeth occasionally lateral, often 5–7 mm high, the spine-tips very short or often 1–3 mm long; veins about 5–7 on each side, the lower ones rather strongly arcuate-ascending and anastomosing near the margins, the upper ones straighter, usually passing directly into the teeth; upper leaf-surface hard, scarcely lustrous, drying dull olive green, at length essentially glabrous except on the scurfy-tomentulose base of the midvein, obscurely rugulose, the main veins a little impressed, the reticulum of small veinlets not discernible or but indistinctly so, the veinlets and the areoles between them not appreciably different in color; lower surface strongly whitened, entirely obscured by a tough thin yellowish-white or grayish-white tomentum, the veins and veinlets elevated and visible even though covered by the hairs; epidermis shallowly bullate, papillose; petioles (5–) 8–20 (–28) mm long, flattened adaxially or unequally biconvex in section, persistently thinly scurfy-tomentulose; staminate aments unknown; pistillate flowers solitary or paired, on a peduncle 3–8 mm long, 1.5–2 mm thick; fruit (according to Trelease) annual, solitary, the cup deeply saucer-shaped, 12 mm in diameter, with thin, appressed, blunt, brownish, pubescent scales; acorn 15–20 mm long, ovoid, covered at base only.

Quercus sideroxyla Humb. & Bonpl. Pl. Aequinoct. 2: [34]39. *pl. 85.* 1809. *Quercus omissa* A. DC. in DC. Prodr. 16, pt. 2: 28. 1864.

Dry, rocky, forested mountainsides with other oaks, 2400–2600 m. Ciudad García, Zacatecas (*M. Martínez 154*); "Sierra Fría," 25 km west of Presa Calles (*E. T. Hooper*); Sierra del Laurel (*Rzedowski 14098*). Chihuahua, western Durango, southwestern Zacatecas, Aguascalientes, Guanajuato (Villalpando, *Humboldt & Bonpland,* the type), San Luis Potosí, Nuevo León. The type of *Q. omissa, Seemann 1969*, probably came from western Durango. "Encino colorado" (Durango).

A small tree, or in Nueva Galicia becoming shrubby, a few meters high; described by Humboldt and Bonpland as a very tall tree with trunk 50–60 cm in diameter; branchlets 1–2 mm thick, covered by a close yellowish-gray tomentum persisting until the second year, becoming reddish-brown with flat inconspicuous lenticels 0.2–0.5 mm long; buds ovoid, 2.5–3 mm long, brown, lustrous, the scales ciliate; stipules caducous, not seen; leaves tardily deciduous, very thick and rigid, oblanceolate to obovate or elliptic-oblong, 3.5–7.5 (–10) cm long, 1.5–3.5 cm wide, 1.5–2.3 times as long as wide, coarsely and sharply dentate and usually obtuse at apex (or the terminal tooth actually triangular), entire from the middle or well above it to the cordate-auriculate or abruptly rounded base, the sides of the blade tending to fold together over the midvein near base*; margins cartilaginous-thickened and strongly revolute, seldom completely

Fig. 37. *Quercus sideroxyla,* × 1. Left to right, *Hooper s.n., Rzedowski 14098* (both from Aguascalientes), *Maysilles 7923* (Durango).

*A condition for which Trelease used the term "convallate."

entire, usually bearing 1–5 aristate, deltoid teeth or low serrations on each side, these usually confined to the distal third of the blade but occasionally lateral, the rather stout short spinelike tips 0.5–1.2 mm long; veins 5–9 on each side, terminating in the teeth when these are present, the others anastomosing near the margins; upper leaf-surface hard, barely lustrous, drying dull yellowish green, finally essentially glabrous except the base of the midvein, obscurely rugulose, the main veins impressed, the reticulum of veinlets barely discernible, the areoles and veinlets not appreciably different in color; lower surface entirely obscured by a dense felt-like yellowish-white tomentum covering the veinlets as well, only the main lateral veins conspicuously elevated above the hairs; epidermis shallowly bullate, papillose; petioles 3–9 mm long, somewhat persistently tomentose, adaxially flattened; staminate aments tomentose, the cup-shaped perianth ciliate on the margins, the anthers 1.3–1.6 mm long, oblong, glabrous; fruit biennial, solitary or paired, sessile or the peduncles up to about 1 cm long; cup hemispheric or the base prolonged, about 10–13 mm in diameter, with thin brownish tomentose scales with obtuse, thin, brown, rather loose tips; acorns ovoid, about 10–13 mm long, 10 mm wide, one-third included.

In Trelease's monograph the plant described and figured (plate 339) under the name *Quercus sideroxyla* is another species, *Q. eduardii* Trel. Humboldt and Bonpland confused the two species in the field and in the herbarium, but the plant described in *Plantae Aequinoctiales* was the one with leaves heavily tomentose beneath, later called by DeCandolle *Quercus omissa.*

Quercus splendens Née, An. Ci. Nat. 3: 275. 1801. *?Quercus sororia* Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 175. 1854.

Humid forested slopes and open woodlands, with other oaks, or oaks and pines, sometimes with *Bursera* and other trees of the tropical deciduous forest, 1100–1600 m. 10 km north of La Cuesta, below the pass to Talpa (*Rzedowski 15140*); between La Resolana and the pass to Autlán (*McVaugh 11940, Wilbur 2277*); Coalcomán (Barroloso, *Hinton 15081*). Mountains of the Pacific slope, little-known from Nueva Galicia; Jalisco and western Michoacán, Guerrero (near Tixtla, *Née,* the type), Oaxaca (in the Chinantla, *Liebmann,* type of *Q. sororia*).

A forest tree up to 12–20 m high, the trunk up to 40–60 cm in diameter, with furrowed gray bark; young leaves and branchlets tomentulose, very soon glabrescent, at maturity quite glabrous or (usually) with some brownish floccose tomentum persisting beside the midvein on the lower leaf-surface, and sometimes simple hairs on the vein itself; branchlets 2–3 mm thick, reddish brown, with numerous pale lenticels; buds 3–5 mm long, ovoid or lance-ovoid, acute, reddish brown, sometimes persistently hairy; stipules subulate, pubescent, persistent about the terminal bud only; young foliage often strikingly reddened, the leaves thinly and evanescently stellate-pubescent above, floccose-tomentose beneath; mature leaves deciduous, coriaceous, whitened beneath, variable in shape even on the same plant, those in mid-twig mostly entire and oblong-elliptic, seldom ovate or lanceolate, those on vigorous branchlets or near the tips of rapidly growing branchlets sometimes sinuately toothed; blades (5–) 10–15 (–20) cm long, 3–6 (–10) cm wide, (2–) 2.5–3.5 times as long as wide, in Nueva Galicia commonly entire and elliptic, more or less equally narrowed to both ends, obtuse or emarginate at apex, cordate or rounded at base, on petioles 5–10 (–20) mm long; some leaves (few, as far as known, in Nueva Galicia) obovate or oblanceolate, with or without 1–3 (–6) blunt or mucronate teeth above the middle on each side; upper leaf-surface hard, reticulate-veined, the main veins slightly depressed, very slightly convex; lower surface with prominent veins and veinlets, waxy-glaucous and papillose,

Fig. 38. *Quercus splendens.* Leafy twig, × ½, *Rzedowski 26208* (northern Jalisco); twig with cups, × 1, *Hinton 15081* (Michoacán); leaves, × ½, left to right, *Muller 9170* (Guerrero), *McVaugh 11940* (Jalisco), *Rzedowski 15140* (Jalisco); hair from lower leaf-surface, much enlarged.

and very minutely granular-puberulent; veins about 8–12 (–15) on each side of the midvein, arching-ascending, much branched and anastomosing near the margins, forming connecting veinlets about as thick as the cartilaginous and very slightly revolute margin; staminate aments probably 6–8 cm long, densely pilose, rather closely flowered, the anthers exserted, 1.3 mm long, glabrous; pistillate flowers 1–5 (–10), scattered along a peduncle 1–2 (–4) cm long; fruit annual, solitary or paired on a peduncle 5–30 mm long; cups hemispheric, 12–18 mm in diameter, the scales much thickened and canescent-tomentose at base, their obtuse narrowly triangular flat tips appressed, silky, 2–3 mm long; acorns 15–25 mm long, 9–12 mm in diameter, about one-half included.

This was long a doubtful species, because Née's description was based entirely on plants with half-grown leaves, that he found near Tixtla, Guerrero, in April, 1791. Recent collections from the type locality (*Muller 9169, 9170*) provide immature leaves that match Née's specimens precisely, as well as mature leaves and fruits by which the species can be identified.

Quercus polymorpha Schlecht. & Cham. (Linnaea 5: 78. 1830), is evidently closely related to *Q. splendens*, and is indeed scarcely distinguishable from it. The two appear to be the eastern and western representatives of a species-pair that is widely distributed in Mexico. *Q.*

polymorpha is a plant of the Atlantic slope, ranging from Tamaulipas and Nuevo León to Veracruz (the type from near Jalapa, *Schiede*), Hidalgo and Oaxaca, and occurring also in Central America. The differences between *Q. polymorpha* and *Q. splendens* have not been fully worked out, but may be summarized as follows:

1. Petioles (6–) 12–20 (–35) mm long; leaf-blades very often of a lanceolate or lance-ovate type, narrowed from the middle or below to a tapering apex but finally obtuse; leaves of rapidly growing branchlets often conspicuously toothed; Atlantic slope of Mexico, and Central America. *Q. polymorpha.*

1. Petioles 3–10 (–20) mm long; leaf-blades commonly elliptic, more or less equally narrowed to the two ends, the apex rather abruptly rounded or obtuse; leaves chiefly entire, sometimes sinuate-dentate; Pacific slope from Jalisco to Guerrero; Oaxaca. *Q. splendens.*

In specimens from Guerrero, the petioles of *Q. splendens* are mostly 3–8 mm long; in our specimens from Michoacán and Jalisco they measure 5–10 mm. In the barrancas of northern Jalisco, and in western Durango, an otherwise very similar plant has petioles 10–20 mm long. These last specimens have usually been referred to *Q. polymorpha*, but they have the elliptic and mostly entire leaves of *Q. splendens*, and may well represent a long-petioled form of that species. *Quercus petiolaris* Benth. (Pl. Hartw. 55. 1840), usually regarded as a synonym of *Q. polymorpha*, probably belongs in part to this population from northern Jalisco. The type collection, *Hartweg 420*, consisted of a mixture of specimens of genuine *Q. polymorpha*, from Hidalgo, and of another population, probably from Bolaños, Jalisco. A recent collection from the valley of the Río de Bolaños (northwest of El Platanar, Mpio. S. Martín de Bolaños, *Rzedowski 26208*), is the same long-petioled form.

Quercus subspathulata Trel. Mem. Nat. Acad. Sci. 20: 56. *pl. 52.* 1924. *Quercus pallidifolia* C. H. Muller, Contr. Univ. Mich. Herb. 9: 522. 1972.

Steep stony hills, in reddish gravelly clay soils, sometimes the dominant tree in open oak woodlands or scattered with pines and other oaks, 900–1200 m. Southernmost Durango (*Rose 2239*!, the type); Santa María del Oro (Los Jazmines, *R. Pérez Cisneros 2135!*, type of *Q. pallidifolia*); km 870, 35 km southeast of Tepic (*McVaugh 16363*); between Milpillas and Escalón, upper slopes of the barranca (*McVaugh 11970*). Northern Sinaloa (Choix, *Castro 2227*); southern Durango; Nayarit and Jalisco, in the basin of the Río Grande de Santiago. "Encino mixcahue"; "encino borrego."

Small straight trees 6–10 m high, with trunk up to 30–40 cm thick; branchlets 2–4 mm thick, glabrous and pruinose-glaucous, finally reddish brown, with pale conspicuous lenticels; buds plump, short-ovoid, rounded, 2.5–3 mm long, 2 mm thick, with obtuse ciliate scales; stipules 3–7 mm long, caducous except on the terminal buds; leaves deciduous, when young colored beneath by the numerous short vermiform glandular reddish or amber-colored hairs; mature leaves light green, pale and often strongly whitened beneath, coriaceous, obovate, (6–) 11–17 (–22) cm long, (3–) 6–12 cm wide, about twice as long as wide, obtuse to rounded or retuse at apex, rounded or auriculate-cordate at the narrow base; margins thickened and slightly

Fig. 39. *Quercus subspathulata,* × ½. *McVaugh 11970* (Jalisco).

revolute, sinuate but scarcely dentate, with 5–10 shallow undulations on each side, the veins mostly 8–10, ascending and nearly straight, the strongest ones reaching the margin at a convexity and sometimes exserted as a low callose thickening, the others branching near the margin and forming interconnecting arches; upper surface hard, slightly lustrous, the small veinlets finely pale-reticulate, the veins with narrow pale borders; main veins convex, flat or but slightly depressed; lower surface waxy-glaucous and at maturity evidently papillose, retaining at least traces of the glandular puberulence but otherwise quite glabrous or bearing a few soft stellate hairs along the larger veins; veins elevated and forming a pale network; small veinlets not discernible except as fine depressed lines in the epidermis; petioles 3–5 mm long, glabrous and pruinose-glaucous, very stout, flattened adaxially, 2.5–3.5 mm wide at base; flowers unknown; fruit annual, 2–3 together near the tip of a glabrous peduncle; cup hemispheric, 10–12 mm wide, canescent-tomentose, the scales short, 2–2.5 mm long, much thickened at base, with narrow, appressed, tapering tips; acorns 22–24 mm long, narrowly ovoid, 8–10 mm thick, light brown, one-third included.

The leaves of this species resemble those of some forms of *Q. tuberculata,* but in the latter, not definitely known south of central Sinaloa, the twigs are only 1.5–2.5 mm thick, the petioles are much longer and not so thick [(5–) 8–12)–20) mm long, 1–2 (–3) mm thick], the leaves are somewhat pubescent at least when young, dark green and very lustrous above, green rather than strongly glaucous beneath. In *Quercus glaucoides,* a species with essentially glabrous leaves glaucous and papillose beneath, the blades are relatively narrow, often oblong-elliptic, seldom more than 4–5 cm wide and about twice as long.

Quercus tuberculata Liebm. Overs. Dansk. Vidensk. Selsk. Forhandl. 1854: 181. 1854.

A species of northwestern Mexico, perhaps barely reaching our area. The type, *Seemann 1970,* was collected probably in Sinaloa, between

Fig. 40. *Quercus tuberculata*, × ½. *Gentry 5226B* (Durango).

Mazatlán and Durango. As indicated by modern collections, the range of *Q. tuberculata* is chiefly from central Sinaloa northward. It is a variable species, and has been independently described under different names in Baja California (as *Q. idonea* Goldman), in Sonora (*Q. standleyi* Trel.), and in Chihuahua (*Q. aurantiaca* Trel.). In a slightly different form it occurs in the Sierra Madre Oriental.

A few collections from central and western Michoacán, taken in areas of tropical deciduous forest where the trees were growing with *Ipomoea, Bursera, Opuntia,* and *Eysenhardtia,* at elevations of 1800–2000 m, are very like typical *Q. tuberculata* and may represent that species although there seem to be no records of its occurrence between Michoacán and Sinaloa: 10 km west of Zamora (*Rzedowski 15508*); 35 km south of Jiquilpan (*King & Soderstrom 4655*).

Small or moderate-sized irregularly branching, short-trunked tree up to 10–12 m high, the trunk to 30 cm in diameter, with thin, flaking gray bark; young branchlets (sparingly) and leaves (densely) finely stellate-pubescent, the hairs nearly all deciduous, a few usually persisting on the mature lower leaf-surface along the main veins, on the upper side of the petiole, and sometimes on the upper side of the blade; branchlets 1–3 mm thick, brown or yellowish brown, with numerous small pale lenticels; buds ovoid, 2.5–3 mm long, with obtuse ciliate scales; stipules 5–6 mm long, persistent only on the terminal buds; leaves deciduous, drying a dark or bronzy green above, paler green (not glaucous) beneath, coriaceous, elliptic to ovate or obovate, 7–15 cm long, (3–) 5–9 cm wide, 1.5–2.5 times as long as wide, broadly rounded or emarginate to obtusely pointed at apex, broadly rounded at base, or often narrowed below the middle and then abruptly or gradually rounded or cuneate above the petiole; margins thickened but not or scarcely revolute, undulate or sinuate-dentate, often with 5–8 ascending, obtuse, sometimes callus-tipped teeth on each side, the teeth extending from the middle of the blade, or well below it, to the tip; veins 8–16 on each side in addition to some intermediate ones, spreading-ascending, sometimes passing directly to

the tips of the larger teeth, but usually branching or equally forking near the margins and forming inter-connecting veins; upper leaf-surface hard, lustrous, flat, finely reticulate, with convex often brownish veins and veinlets; lower surface evidently paler, with more conspicuous and more strongly elevated veinlets, usually with soft pubescence persistent at least along the midvein but not forming strong axillary tufts, the epidermis lustrous and at maturity papillose; petioles reddish, smooth, (2–) 5–10 (–20) mm long, convex adaxially, enlarged toward base and there 1.5–2.5 mm thick; staminate aments 5–8 cm long, interrupted, the anthers exserted, obtuse at base and apex, apiculate, pilose, 1 mm long, about as broad as long after opening; pistillate aments up to 3 cm long, verticillately several-flowered, one or two sessile flowers at the very base often maturing, the fruit thus sessile and axillary; cups about 14–15 mm wide, 9–10 mm high, hemispheric, tomentose, the outer scales globose- or umbonate-thickened, or keeled, the inner ones with erect appressed blunt triangular tips about 2 mm long; acorns ellipsoid, obtuse or acute, smooth, tomentose at apex, 2.2 cm long, 1.3 cm thick.

Quercus urbanii Trel. Proc. Am. Philosoph. Soc. 60: 32. *pl. 2.* 1921; Mem. Nat. Acad. Sci. 20: 133. *pl. 253.* 1924. *Quercus radiata* Trel. Proc. Am. Philosoph. Soc. 60: 33. *pl. 3.* 1921; Mem. Nat. Acad. Sci. 20: 134. *pl. 253.* 1924. *Quercus pennivenia* Trel. Mem. Nat. Acad. Sci. 20: 135. *pl. 256.* 1924.

Mountainsides, rocky slopes, stream-valleys, with other oaks in moderately dry open woodlands, or in humid oak-pine forest, 2000–2500 m. Santa Teresa (*Rose 2230*!, type of *Q. radiata*); region of Huejuquilla (*McVaugh 12026, 17668, Rzedowski 9106*); San Martín de Bolaños (*Rzedowski 26131*). Sonora, western Durango (*Maysilles 8252*), southern Zacatecas, northern Jalisco, northern Nayarit; Edo. de México; Guerrero ("Sierra Madre," *Langlassé 1066*!, the type). The type of *Q. pennivenia* presumably came from western Durango, northern Nayarit, or adjacent Sinaloa (*Seemann 1998*).

A tree 6–12 m high, with trunk 15–30 cm thick or more, stout densely tomentose branchlets and stiff cupped or spoon-shaped leaves; branchlets 5 (–10) mm thick, the grayish-yellow tomentum persisting for 2 or more years, the bark dark reddish brown to black, with inconspicuous lenticels; buds 3–7 mm long, ovoid, brown, the scales silky, sometimes glabrescent; stipules 6–10 mm long, linear, pilose, deciduous before the leaves mature, or somewhat persistent on the terminal bud; leaves thick and rigid, at maturity always cupped, concave beneath, pale and softly pubescent beneath, mostly broadly obovate to suborbicular or pandurate*-orbicular, seldom ovate-elliptic, (7–) 10–20 cm long, (4.5–) 6–12 (–18) cm wide, often 1.5 (–2) times as long as wide, or the length and width about equal; blades broadly obtuse or rounded at apex, occasionally acute or with a deltoid aristate tip, rather deeply cordate at base; margins cartilaginous-thickened, revolute (apart from the hollowed-out form of the blade as a whole), usually subentire but undulate with 1–10 aristate projections on each side above the middle, the aristae sometimes terminating low broad teeth or serrations; veins about 5–9 on each side, ascending, the upper ones sometimes passing directly into the stronger teeth, but most of them forking and anastomosing well within the margin and some of the aristae terminating small secondary veins; upper leaf-surface hard, somewhat lustrous, pale green in drying, glabrous or nearly so except at the base of the midvein, strongly rugose, the veins and larger veinlets impressed, the smallest veinlets pale, seldom contrasting strongly with the green areoles between them; lower surface persistently pale-tomentose, the hairs erect, long-stipitate, their tangled

*Pandurate, "fiddle-shaped," i.e. curving in below the broad apex, then curving out again to a somewhat narrower base.

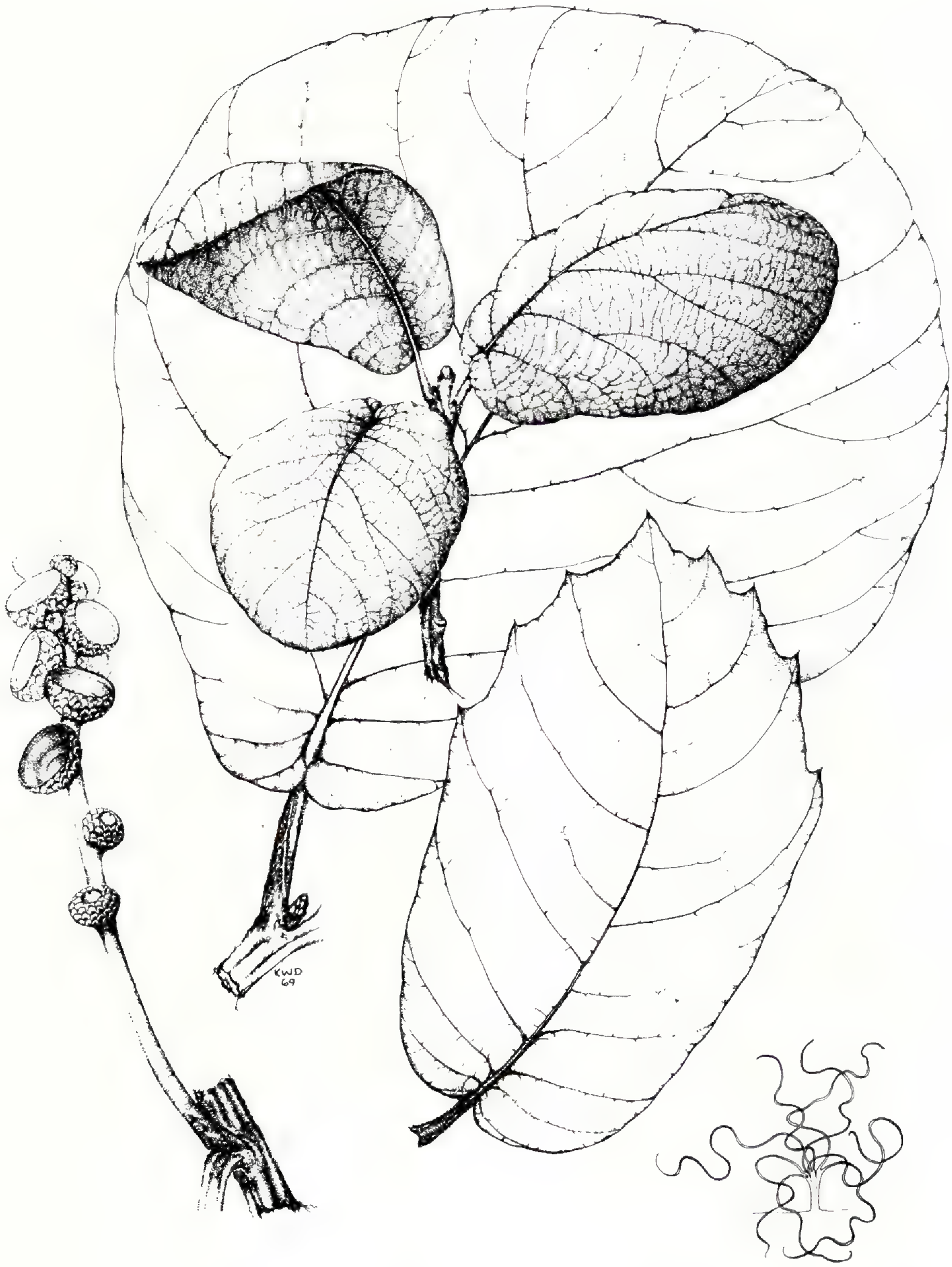

Fig. 41. *Quercus urbanii.* Large leaf, × ½, *Rzedowski 22126* (México); leafy twig, × ½, *Rzedowski 26131* (northern Jalisco); peduncle with cups, × 1, *Rzedowski 26131* (arrangement of cups on peduncle modified from *Rose 2230*, northern Nayarit); small leaf, × ½, *McVaugh 12026* (northern Jalisco); hair from lower leaf-surface, much enlarged.

branches covering but scarcely hiding the pale green, strongly papillose and sparingly glandular-pubescent epidermis; veins elevated, pale and reticulated, the smallest veinlets obscured by the hairs; petioles 8–15 (–30) mm long, 2–3 mm thick, tomentose, often depressed in the narrow sinus between the approximate or even overlapping lobes of the leaf-base; staminate flowers unknown; pistillate flowers few–25, in rather close spike-like clusters toward the tips of tomentose peduncles up to 5–8 cm long, 2–3 mm thick; fruit annual, 6–10 or more maturing in peduncled spikes, the cups small, 7–10 (–15?) mm

wide, hemispheric, the thin (almost papery) reddish brown appressed scales obtuse, appressed-pilose, ciliate; acorns (according to Trelease) ovoid, 8–10 mm long, canescent, half-included.

Quercus uxoris McVaugh, Contr. Univ. Mich. Herb. 9: 513. 1972.

Steep wooded humid mountainsides and barrancas, with pines and other oaks, or with oaks and other broad-leaved trees (species of *Prunus, Fraxinus, Magnolia, Carpinus*) and sometimes *Podocarpus,* 1200–1700 m. Above La Cuesta, below the pass to Talpa de Allende, 1200–1500 m, abundant (*McVaugh 20292,* the type; *21300*); 15–18 km south of Talpa, headwaters of Río de Talpa (*Rzedowski 15067, McVaugh 21446*); 20 km southeast of Autlán (above Ahuacapán, *Rzedowski 14548, 14551*); south-facing foothills 40 km southeast of Autlán (*McVaugh 23249*); Monte de San Antonio, Colima (*Ma. de la Luz Nápoles,* ENCB 772). Southern Jalisco and Colima; also in the Sierra Madre del Sur of Guerrero (*Rzedowski & McVaugh 47*).

A large forest tree, up to 20–25 m high, the trunk up to 1 m thick or more; branchlets 2–4 mm thick, at first tomentose with rather coarse golden or brownish-

Fig. 42. *Quercus uxoris,* × ½. Leaf at right from *Rzedowski & McVaugh 47* (Guerrero), the others from the type.

yellow hairs, the tomentum persistent for a season or more, or gradually wearing off the first season, the bark dark reddish brown to black, with prominent pale lenticels; buds 2–4 mm long, ovoid, short-acute, brown, nearly glabrous, the inner scales ciliate; stipules 10–15 mm long, linear or the upper nearly filiform, scarious, membranous, pilose, deciduous before the leaves are half grown, or those on the terminal bud persistent for a time; leaves deciduous, turning yellow and falling in October or November; very young leaves minutely glandular-granular with pale hairs, and also stellate-pubescent with larger, golden erect hairs about 0.5 mm across, the hairs densely covering and coloring the lower surface, the larger veins thickly pilose with straight simple hairs up to 1–1.5 mm long; upper surface thinly stellate with scattered long simple hairs; mature leaves coriaceous, ovate or obovate to elliptic, (10–) 15–26 cm long, (3.5–) 6–10 cm wide, mostly 2.5–3 times as long as wide, acuminate or attenuate at the narrow aristate tip, rather broadly rounded at base (e.g. in ovate leaves) or more gradually narrowed to a subacute base (often on the same plant in obovate leaves); margins bearing 10–14 ascending long-aristate teeth on each side, thickened and revolute between the teeth, entire in the basal 3–4 cm only; teeth asymmetric, separated by deep curved sinuses, narrowly triangular and up to 1–2 cm high including the aristae 5–10 mm long, or low and obtuse, the margins then evidently aristate but scarcely incurved between the aristae; lateral veins on each side about as many as the teeth, ascending, most of them terminating directly in the aristae; upper leaf surface hard, dark green, lustrous, at maturity essentially glabrous except near the base of the midvein, the large veins showing as fine white lines, often slightly impressed, but convex, the veinlets slightly elevated as pale sharply defined thin lines; lower surface slightly yellowish, persistently stellate-pilose, the epidermis pale green, lustrous, papillose but otherwise smooth; large veins pale and strongly elevated, the veinlets convex, a little thicker and more contrasting than those of the upper surface; petioles (8–) 12–30 mm long, 2–3 mm thick including the subpersistent tomentum; staminate aments 6–12 cm long, pilose with mostly simple hairs, loosely flowered, the perianth broadly campanulate, 1.5 mm high, its obtuse lobes long-ciliate, the anthers glabrous, apiculate, 1.3 mm long; young pistillate flowers pilose, paired, sessile; acorn-cup (from *Rzedowski 14551*) rather flat, 20–22 mm wide, about 8 mm high, the scales a little thickened at base, silvery-pubescent, with broad, obtusely triangular erect appressed tips; acorn short-ovoid, truncate at base, 18–19 mm long, 16–17 mm wide, about one-third included.

Evidently closely related to *Quercus acutifolia* Née, but with much larger leaves than usual in that species, and more copious pubescence. Additional fruiting material is much to be desired.

Quercus viminea Trel. Mem. Nat. Acad. Sci. 20: 123. *pl. 222.* 1924. *Quercus bolanyosensis* Trel. Mem. Nat. Acad. Sci. 20: 123. *pl. 223.* 1924.

Dry or humid oak-pine forest, open north slopes or thickets along streams, 1500–2500 m, little-known in Nueva Galicia. Sierra de Nayarit, northwest of Mesa del Nayar (*Norris 14243*); Dolores to Santa Gertrudis (*Rose 2031*); Sierra de los Huicholes (Rancho de los Padres to Navidad, *Philbrick & Lewis*); Sierra Madre west of Bolaños (*Rose 2958*!, type of *Q. bolanyosensis*); Ixtlán (Arroyo Seco, *Reyes P. 2246*); San Sebastián (Real Alto, *Mexia 1736*); 17 km west of Guadalajara (*Detling 8885*); Zapopan (La Venta, *Díaz Luna 106*). Sonora, western Chihuahua (*Endlich 790c*, the type), Sinaloa, western Durango, northern Nayarit, northern and western Jalisco. "Encino sauce" (Nayarit).

A medium-sized tree, up to 10–15 m high, the trunk 30 cm in diameter with hard furrowed bark; branchlets 1–1.5 mm thick, strongly fluted, at first densely glandular and somewhat stellate-pubescent, soon glabrescent, purplish-brown with many

Fig. 43. *Quercus viminea,* × 1. Left to right, *Detling 8885* (Jalisco), *Muller 9049* (Durango).

prominent pale lenticels, nearly glabrous but retaining traces of the dingy glandular-granular puberulence in the grooves and other protected spots; buds 2.5–3 (–6) mm long, ovoid, becoming long and narrow, the scales long-ciliate; stipules lance-subulate, 5 mm long, deciduous before the leaves mature; leaves green or yellowish green, rigid and coriaceous, nearly flat, narrowly lanceolate, 7–15 cm long, (1–) 1.5–2.5 (–3.5) cm wide, (4–) 5–6 (–11) times as long as wide, widest in the basal third or near the abruptly rounded or subcordate base, and from there long-tapering to the attenuate or narrowly acute, often aristate, apex; margins strongly thickened but not revolute, completely entire or bearing 1–2 sharp, spreading-ascending aristate teeth near the tip of the blade, the teeth hardly as long as the aristae, or narrow, prolonged, up to 8–12 mm long; lateral veins 6–9 on each side, weakly developed at the narrow tip of the blade, the middle and lower ones strongly ascending from the base or arching-ascending with prolonged ascending tips; upper leaf-surface hard, lustrous, at maturity glabrous or with some very small stellate hairs, nearly flat, the veins and veinlets convex, pale, contrasting with the green spaces between them; lower surface a little paler and yellower, usually retaining traces of glandularity, and tufts of coarse stipitate hairs in the axils of the large veins, the veinlets usually less prominent than on the upper surface; petioles 8–15 mm long (seldom 3–5 mm on all the leaves of one

plant), at first glandular and stellate-pubescent, at length nearly glabrous, reddish, much flattened near the base of the blade and there 1–1.5 mm wide; staminate flowers unknown; pistillate flowers strongly pilose, usually 1 or 2, near the tip of a smooth shining stout glabrescent reddish peduncle 4–9 mm long; fruit biennial, solitary or paired, the cup hemispheric or depressed, 10 mm wide, the thin, appressed, pale-pilose scales with broad, rounded tips, the inner ones often infolded; acorn about 10–12 mm long, elongated-ovoid, half-included.

FINDING-LIST FOR NAMES OF SPECIES OF *QUERCUS*

Encina 4

Encino 4

Encino de asta [hasta] 21, 71, 80; avellano 76; avellano cimarrón 44; blanco 15, 21, 46, 61, 80; borrego 85; chaparro 4; chico 33; chililllo 31, 44; colorado 4, 71, 82; cucharilla 4; de hasta [asta] 21, 71, 80; de hoja menuda 80; laurelillo 15; mixcahue 85; prieto 46, 80; roble 4, 46, 48, 61; sauce 91; saucillo 15; tepozcohuite 15; verde 26

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